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EDITORIAL NOTES—GAS, &c.

Ventilation in Places of Assembly.

THE day of rule-of-thumb has passed away in connection with the lighting of schools, remarked Dr. James Kerr, the Medical Officer of the Education Department of the London County Council, the other night towards the close of the discussion on the subject at the meeting of the Illuminating Engineering Society. We wish Dr. Kerr had added to this sapient remark one to the effect that, in association with the subject of illumination, some old arbitrary notions should be put upon trial in a scientific way to ascertain their right or otherwise to continued existence and credit. We rather think that Dr. N. Bishop Harman, who was one of the authors of the papers on the question of school lighting that have been engaging the attention of the Society at their last two meetings, is possessed by some queer old notions in respect of gas lighting to which, so far as we gather, he has not applied any scientific test to ascertain their claim to validity. It may be suggested that his ideas, in this particular direction, require substantial modification; and we will endeavour to show cause for this suggestion.

Dr. Harman's views on all but one point in relation to this question of lighting do not, for the purposes of this comment, really concern us much. The point excepted is ventilation in connection with lighting. In respect of this, we should like to see Dr. Harman converted by the thoroughly scientific proofs that are available to all who choose to do the right thing, instead of taking the easy and dangerous course of putting forward mere impressions as solid truths. It is remarked that Dr. Harman states that the one sole advantage of inverted gas-burners is the absence of shadow below the light, and the correlated ease of securing good reflection. Now every practical lighting engineer knows that, to submit absence of shadow as the sole advantage of the inverted burner, is demonstrably inaccurate. Indeed, putting forward such a statement in a paper before a technical society tends to entitle one to less confidence in certain other of its points. Another assertion was that, from a number of experiments, the least possible illumination permissible on the school desk of a child has been found to be equal to 10 metre-candles—that is to say, about 1 foot-candle. That was a point that was very properly attacked, on the score of insufficiency, by speakers in the discussion. Dr. Harman, in replying, admitted that perhaps he ought to have revised the 1 foot-candle; and there appears to be the trace of an excuse in saying that his work in connection with this subject commenced in the days of the old flat-flame burner. There is the danger of misleading through the expression of antiquated notions in any paper that may be hereafter consulted by those seeking information on the subject; and it is therefore a pity that, for the purpose of papers that are likely to be referred to for guidance, views and theories are not corroborated, and if necessary modernized, before being set forth as irrefragable.

Perhaps the same reason for Dr. Harman's opinion in respect of the 1 foot-candle will apply to his view on the subject of gas lighting and the contamination of the atmosphere—at any rate, we submit, with a large amount of confidence, that his views thereon also require revision. There was first of all an insight into the Doctor's views when he remarked in his paper that with gas the fewest number of burners is desirable; for the more burners the worse the atmosphere. Mr. F. W. Goodenough, in the discussion, referred to work that had been done in the direction of disproving the indictment of gas lighting in this connection. Dr. Harman did not dispute the accuracy of this work; but, in his reply, he shifted a little bit to more neutral ground by remarking that he thinks the claim that gas burning in rooms improves ventilation, has shown itself to be on its last legs. It is not a question of merely thinking. Is it so, or is it not? Has Dr. Harman put the matter to any definite scientific test such as Dr. Toogood has done at the Lewisham Infirmary? If he has not done so, why such an omission before giving utterance to statements that are neither positive nor bear the character of mere suggestion, but have a place between the two? He steps a little further from definite ground, and, in doing so, rather confirms the idea as to the absence of personal scientific investigation on the point, when he says that it is conceivable that gas-burners can improve the ventilation of a room if everyone is provided with a shaft. That is an exceedingly feeble reply to the challenge expressed in Mr. Goodenough's suggestion that a test should be made of the air of two schoolrooms in which children are assembled at the time they are illuminated—the one by gas, and the other by electricity. Dr. Harman did not jump at the idea. We are sorry for this; and we hope he will yet arrange for it to be done, as it would give him an opportunity of either confirming or questioning the results of Dr. Toogood's tests at the Lewisham Infirmary, where (he might note in passing) a large amount of gas was being used at the time, and the ventilating arrangements were of quite ordinary character. Scientific investigation is always more acceptable (when it is truly scientific, and not merely so-called) than any amount of arbitrary opinions formed—apparently in this instance—long ago when the conditions were not the same as those existing at the present day.

It seems clear to us that Dr. Harman has here a problem that he has considered in quite an inadequate fashion, and what is more from the wrong end. If in any place where people assemble when artificial lighting is required—if in any school where children assemble when artificial lighting is needed—the ventilation is not sufficient for gas lighting then, *à fortiori*, the ventilation is not of a character that should be permitted to continue in a place where adults or children are permitted to gather together. We ask Dr. Harman pointedly whether this is not so? We ask him, too, whether, if the ventilation is adequate, the natural actions produced by a lighted flame will not assist in air induction and eduction? These are two plain, straight questions, which only call for a plain and straight answer. It follows that, if Dr. Harman cannot reply to the first question in the affirmative, then some one is at fault in not taking steps to ensure that the sanitary conditions of the schools or other places of meeting are all they should be. In places where electric light is used, and people—children or adults—assemble during the hours when artificial lighting is required, it is absolutely necessary to have mechanical means of ventilation unless conditions repugnant to health are allowed.

The Electricity Publicity Committee have pointed this out in their literature by stating that "wherever electric light is "installed, the air in the rooms can be kept fresh and pure by "means of electric ventilating-fans. . . . Indispensable "for keeping the house healthy." Even electric fans are not always successful in an electric lighted hall. On Jan. 26 members of the Institution of Electrical Engineers were meeting in their new lecture theatre, with its reflected lighting and its electrical ventilating arrangements; and yet the "Electrical Times" had occasion, in its succeeding issue, to call attention to the bad ventilation and the stagnant condition of the air. Said our contemporary: "The evening was "rather sultry, there was a large audience, and complaints "of the poor ventilation were heard on all sides. Fortunately, "it is quite an easy defect to remedy; it is not a question "of excessive heating, so much as of stagnant air which is "not being passed out of the building quickly enough." To a medical man, the expression "stagnant air" has a very broad meaning, and covers much impurity and various undesirable conditions. The same complaint has been made in connection with other electrically lighted places where people assemble. If Dr. Harman will ponder over these points, he may see things in a new light. Our electrical contemporary has had occasion since the publication of the quoted remarks to try to discount their weight when applied to the new home of the Institution of Electrical Engineers.

It has since said that "electric lamps neither ventilate, kill "bacteria, nor do anything else, good or bad, save to give "light." That is just the point. If the electric lamps at the Institution of Electrical Engineers had been capable of rendering some assistance to the ventilation of the lecture theatre, there might not have been the complaint as to the stagnant air: "They have no more effect on ventilation than "daylight has." It is usually at night time that people assemble, and when artificial lighting is needed; and if the lighting can be brought effectively into play in assisting ventilation, so much the better. Electric lighting, it is confessed, cannot render aid in this direction. Taking these various points into consideration, we invite Dr. Harman to overhaul his opinions on the subject of ventilation and artificial illuminants, and ascertain whether or not they are altogether as sound, and capable of the fullest substantiation, as it is desirable the views on this subject of one in his position should be.

Competition at Sheffield.

CHEAP gas and a forward policy enable the Sheffield Gaslight Company to show, year by year, a marked advance in their commercial and financial position, despite the frantic efforts made by the Electricity Department to cut into their prosperity. Information as to the character of the competition that the Company have to meet, and their success in meeting it, the undue favouring of the Electricity Department in comparison with the Gas Company in the matter of rating, and much else can be obtained from the excellent fighting speech of Mr. Wilson Mappin at the annual meeting of the shareholders. The benefits of prosperity go in these days to the gas consumers, seeing that the Company are working under a maximum dividend; and at that the participation of the shareholders in the profits have stopped for a long period. The Company therefore, in operating for further prosperity, while by their success they are hardening the security of the shareholders, are working for the benefit of the consumers. In this, they are good servants of the public; and no greater testimonial to this is required than the average price of 1s. 2·94d. per 1000 cubic feet that is being received by the Company to-day. In view of these facts, all the talk as to the gas consumers being the debtors of the Electricity Department for having driven down the price of gas by their competition is about as fatuous as it can well be. With such a price, with heat units at such a remarkably moderate cost, there cannot fail to be business development; and there was last year an increased income from gas of £11,333.

In every direction the gas business extends; and Sheffield, with its numerous hives of industry in which metal working is carried on, affords a highly interesting example of the popularity of cheap gas for heating and power purposes. No less than 81 additional gas-heated furnaces were put in by the Company during last year, apart from those installed privately. Gas-engines to the number of 68 were also connected up. In domestic heating, progress is on the high scale. Notwithstanding this good service, the heavy sum now paid in rates, and the effect of the displacement of solid fuel by gaseous upon the atmosphere of the city (and verily it will still stand a lot of improvement), the municipal Electricity Department regard it as a legitimate part of their duty to slander the gas supply. It is pitiful to see the electricity industry hand in hand with gross misrepresentation in order to damage the business of the successful competitor. But, so far as Sheffield is concerned, Mr. Wilson Mappin smote the rivals hip and thigh, and confounded them with his points. It was an especially nasty knock that he was able to administer in reply to the scandalous character of the assertions as to air pollution by gas. The atmosphere of the electrically lit City Council Chamber was found so noxious a time ago that the Medical Officer of Health was instructed to make a scientific examination of the air, and lo! he found that it contained four to five times more carbonic acid than the outside air. To such a facer, the Electricity Department can only reply that the condition of the Chamber has since been improved—of course, by special means. But this does not dispose of the fact that, electrically lighted though the Council Chamber was, the condition of the atmosphere was terribly bad, and we doubt not that the carbonic acid found was of the character that authority tells us is infinitely more dangerous to health than the chemically harmless and inactive carbonic acid produced by the combustion of gas. There has been some attempt to reply to the case put forward by Mr. Mappin; but it has been a prosaic effort, supported by the sayings of the well-known band of misinformed antiquarians.

Fires: Electrical and Gas.

THE report of the Fire Brigade Committee of the London County Council for 1910 is now before us; and the electricity supply industry will have some difficulty in tracing in it any support for the much damaged legend as to electricity being "the safest illuminant." In respect of safety, gas maintains its superior position. It remains practically where it was in 1909 in regard to the total number of fires in which it was identified in any way; while the number of fires for which electricity can take credit has made a marked ascent. When we come to divide the number of consumers by the number of fires, gas is in a better position than in 1909, while electricity is in a worse one. Reckoning all the fires in which gas in any way had part, including curtains being blown on to, and clothes coming into contact with, gas-flames, we can count 334 cases, against 332 the year before. The official classified summary of causes only accuses gas of having been responsible for 195 fires; but to please our electrical well-wishers, there is no hesitation to pile on to the smaller figure every bit of carelessness that brought clothes or combustible material into proximity with a visible flame, and so caused ignition. To set against this, there were 142 fires in which electricity was concerned. The official classified summary gives 128; while the detailed summary attributes 138 to defective electric circuits. Thus there is a discrepancy between the classified and detailed summary. The 142, however, compares with 103 in 1909.

The three London Gas Companies had at the end of last year approximately 1,120,000 consumers (leaving entirely out of count the numerous purposes other than illumination for which gas is used); and therefore, taking every little fire in which gas was implicated, and the total of 334, we arrive at an average of one to every 3352 consumers, compared with 3012 in 1909. This is an improvement. Taking the latest available statistics as to electricity consumers, and estimating the figures for the two or three concerns whose returns are not available up to date, we calculate that the London Borough Councils supplying electricity and the Electricity Companies, covering together a larger area than the three London Gas Companies, have only 130,000 consumers or thereabouts. The fires entered in the detailed summary against electricity, numbering 142, therefore represent 1 to every 915 consumers, as compared with 1 to 1113 in 1909. This is not an improvement; and it shows the complete absence of truth contained in the statement as to the greater safety of electric lighting compared with gas. The safety is on the side of gas.

There is another point. Nearly all the gas fires could be ruled out if carelessness and negligence were awarded their share of responsibility. There cannot be a gas escape without the nose is made acquainted with the fact; and out of the 334 fires we have mentioned as traceable in any way to gas, 101 were due to gas escapes. Another 18 were due to that time-honoured piece of lunacy, searching for a leakage with a light; while no less than 119 were owing to curtains, clothes, and other combustible articles being allowed to come into contact with gas-flames. This is entirely attributable to negligence on the part of the user. But in regard to electricity, there is the outstanding fact that defective electrical circuits mounted up from 95 in 1909 to 138 in 1910; and no consumer could have been conscious of any one of these 138 defective circuits until the trouble was right upon him. The private consumer, the tradesman, and others cannot expect to be immune when electricity works have during the year had eight fires booked up to them through defective circuits. Even the Fire Brigade own up to an instance at one of their stations, which is bad. Two cases are recorded at hospitals; and one at a school. Hotels, restaurants, shopkeepers, and householders had their experiences; and they do not forget to talk about their alarm, and of their terribly shaken belief in the statements printed in electrical literature. How many, too, of the 398 fires entered up under "cause unknown" ought truly to be placed to electricity? As an originator of fires, its work is more difficult to trace than any other cause, when no one sees the locality of the outbreak. During 1909, there were only 288 fires the causes of which were marked "unknown;" so that the total last year was greater by 110. This is a serious and uncomfortable condition of things upon which to reflect.

We are not going to say much about fires at drapery

establishments on this occasion ; but if we look at the causes of fires at such places, it is seen that three were known to be due to defective electric circuits. It is mentioned that four of the fires caused serious damage. One of these occurred on Jan. 13. Turning to the "Short Reports of Serious Fires," it is seen that this was the disastrous Kilburn fire. The local Electricity Engineer has not yet come forward with the proofs he promised that this fire was not caused by electricity. The other dates of serious drapery fires correspond with two of the Brixton conflagrations and the one at Pentonville.

Gas-Fired Steam-Boilers.

Are we nearing the time when steam-raising by the use of raw coal will be a thing of the past, and when the gaseous firing of boilers will become the recognized mode through enhanced efficiency and general economy? This double-barrelled question, on even cursory consideration, presents fascinating points for all engineers, and not by any means least for gas engineers. For them, it has two-sided interest. In the first place, most gas-works are large users of steam for driving purposes; many require considerable supplies for carburetted water-gas manufacture ; and those gas makers who work up their own secondary products need a goodly supply in this part of their operations. And in the second place, a practicable method of applying gas to the firing of boilers—having regard to all financial considerations—will give to the suppliers of cheap gas new scope for business. There is very strong inducement to a consideration of the matter by the publication to-day of a specification of a patent by Professor W. A. Bone, Mr. James W. Wilson, and Mr. C. D. M'Court, relating to improvements in respect of steam generation, feed-water heating, and the heating of liquids generally. Only a fortnight ago, we were commenting upon the work of these three inventors in connection with gaseous heating and the prospects—work that has its seat to a very large extent in the results of the researches for some time since of Professor Bone into the accelerating influence of the incandescent surfaces of solids upon gaseous combustion. In that comment, mention was made of the fact that, in applying the results of their joint work, it was proposed to proceed in development from the end of the larger purposes for which heat is required. This they are doing, as may be seen from the specification now before us, which may be taken to be, from the standpoint of practical application, the most important yet published.

Before proceeding to consider possibilities, we may just describe in bare outline this new system of steam-raising by gaseous firing. The principal objects of the invention, as stated by the patentees, are to utilize for the purpose in view a maximum or large proportion of the available heat produced, to transmit such heat rapidly from the seat of combustion to the liquid to be heated, and to transmit a large proportion of heat per unit area of heating surface. Any kind of gas may be used—coal gas, coke-oven gas, producer gas, blast-furnace gas, natural gas, or other gases, or mixtures of gases amenable to the method of procedure, or, in certain cases, hydrocarbon vapours may be employed. Into a tube or tubes (as may be required), packed with granular refractory material, and running through the body of the liquid to be heated, is passed a mixture of the combustible gas and air in the proportions theoretically required for complete combustion, or with the air in slight excess—the mixture being sent in at a pressure sufficient to overcome the resistance to the gaseous flow exercised by the granules of refractory material, and at such a speed that back-ignition of the mixture is prevented. Ignition is made at the exit end of the tubes, and the flame travels back through the bed of the granules of refractory material ; combustion then proceeding at the entrance. The result is that the granules in the zone of combustion are raised to a state of high incandescence. The products of combustion can be passed away immediately from the rear end of the tubes, or the tubes can be returned through the water, so that a proportion of the heat of the products may also be utilized in useful work. Another use (to which reference will be made presently) can also be profitably made of the hot gases leaving the boiler. This is a general outline of the system, without going into detail, which may be ascertained by a brief study of the specification. In considering the details, it strikes one, speaking without the aid of a working experience of the system to guide judgment, that the inventors have well covered essential precautions and provided against various obvious difficulties—such as back-firing, the blocking of the granules of refractory material, the prevention of the destruction of the tubes at the points of greatest heat intensity, and the provision at those places of refractory material granules of great heat-resisting power. Of course, the mode of construction, the dimensions, and so forth depend on several factors—such as the calorific power of the gas used, the temperature at which the products of combustion shall leave the boiler, and so forth.

Naturally, a proper balance-sheet of economies in contrast with the old system of steam-raising by raw fuel can hardly be expected until there has been practical application and some experience. For this we must wait. Experience alone will settle the point, for example, of wear and tear. Much, of course, will depend upon the cost at which the gas can be delivered at the boiler ; but it is manifest that gaseous firing must result in material savings in several other directions. The financial considerations are, in fact, of a somewhat extensive character. But the specification gives certain insight into the possibilities from the standpoint of efficiency. With tubes containing an incandescent mass traversing the water or other liquid to be heated, it is clear that the heat transfer will be high ; and in trial work (it is mentioned in the specification) the inventors found about 90 per cent. of the total heat available from the gas was transferred to the water. But there has been a further improvement since the complete specification was filed. By means of a simple feed-water attachment (only a foot long, working on the same principle as the boiler, and through the tubes of which the hot gases leaving the boiler are passed), the inventors are, we learn, able to raise the efficiency of the boiler to 94 per cent.—that is to say, 94 per cent. of the net calorific value of the gas is actually transmitted to the water in the boiler! Now, if this efficiency is attained in practice, it will be a truly remarkable performance. If a gas-fired boiler, with a high evaporative duty, can be constructed and worked with coal or coke-oven gas with a 94 per cent. efficiency, instead of some 60 to 70 per cent. as heretofore, and other conditions do not detract from the economy represented by such efficiency, then there will be substantial ground for the belief that the opening question of this article may be answered in the affirmative, and that we are on the verge of a complete transformation of boiler-house conditions and practice.

Gaseous firing (which in crude form at coke-oven and blast-furnace plants is not new) in the boiler-house is ideal ; but it is a little early, in connection with the introduction of the system before us, to consider anything but possibilities. Nothing need be said as to scope. Most industries require steam—even the electrical industry for its prime movers. Economies are an important aspect. There are the capital and the upkeep economies. Chimney shafts for coal-fed boilers are costly things. The boiler-house without a tall chimney shaft would be a less expensive structure; and it would eliminate an eyesore from our landscapes, and a source of air pollution from our towns. There should be some economy, also, in the construction of the boilers themselves. Generally speaking, the boiler tubes under this system would be shorter than those usually employed ; and certain of the accessories to the coal or breeze fired boiler would not be required. The even distribution of heat is a matter of importance when considering wear and tear. There would be no cutting and destructive local temperatures to deal with, which are especially met with where liquid fuels are employed. Picture the boiler-house, too, that does not require stoking and clinkering, and think over the labour effect. We might go on picturing possibilities. Consideration, however, may end here for the time being, with the remark that progress cannot be stayed in anyone's interest, not even in the interests of the market for gas-works breeze.

A Visit to Chard.

An interesting and useful meeting of the South-West of England Association of Gas Managers was held last week at Chard. As the Mayor said in welcoming the members, Chard is not a large town, but it possesses a gas-works conducted on progressive lines; and as the majority of members of the Association come from works of moderate size, they were able to appreciate at their true worth the difficulties encountered, and the measure of success achieved, in an undertaking working on lines with which they are themselves familiar. The chief trouble of those who have the management of the Chard Gas-Works is the heavy

charge on the loan account. Mr. A. S. Brook, the Engineer and Manager of the works, spoke of the capital account as inflated to the point of bursting. There is no doubt the old Gas Company did exceptionally well in the arbitration which fixed the purchase price; and the Corporation have a correspondingly heavy burden to bear. They are to be congratulated on having adopted the best means of meeting the difficulty. Instead of starving the works because the capital outlay was already heavy, they have endeavoured to keep them up to date, and have cast about for means of cheapening the production and getting the best results. In thus acting on the advice of their Engineer, they have achieved a certain measure of success; and though some years are likely to elapse before the Chard ratepayers reach the promised land of realizable profit, they have no little reason to be proud of their gas-works. In addition to visiting the gas-works and discussing points raised in Mr. Brook's paper describing the works, the members of the Association had the opportunity, in a visit to a local engineering works, of seeing some of the latest machinery for use in the application of tar to road making. This is a subject which touches gas managers nearly; and the information gained will no doubt be of value. Altogether the day spent at Chard was both pleasurable and profitable.

A Minimum Wage at West Ham.

At intervals West Ham is brought before the public notice as a fairly heavily rated district; but the anxieties of the general body of ratepayers do not so far monopolize the attention of the members of the Town Council that they are unable to find time to attend to the requirements of the particular section of the community who happen to be in their employ. This is evidenced by the fact that at a meeting of the Council some days ago a large proportion of the sitting was devoted to a discussion of the principle (which was ultimately adopted) of a mininum wage of 30s. per week for adult employees—a matter which came up on reports of the Public Health and Works Committees. The Public Health Committee recommended that all male employees over the age of 21 at present receiving less than 30s. per week receive in future a minimum wage of 30s., except in cases where there are recognized Trade Union rates, when such rates shall apply, provided that any payment at Trade Union rates shall not be at a rate less than 30s. per week; and that in all cases where workmen are paid an hourly rate, and work varying hours in summer and winter, such hourly rates be increased wherever necessary, so as to ensure a minimum wage of 30s. for a full week all the year round The Committee also recommended that the wages of youths should vary from 14s. a week at 14 years, to 22s. a week at the age of 20. The Works Committee made the same recommendation with regard to the 30s. minimum; and, further, that all labourers and casual workmen be paid a minimum rate of 7½d. per hour, and that the wages of the watchmen be increased to 6d. per hour. The question of cost was naturally raised by some members; but on this point the Deputy-Mayor (Alderman D. J. Davis) is reported to have said: "It matters little to us what it costs. I say that carefully. We are pledged; and we have been returned to the Council on this subject." This was an easy method of turning away from the practical aspect of the proposal; but Alderman Thorne was more explicit; his estimate being that, on the very highest computation, it would not cost more than £2000 a year, which "was not a very big sum, considering the number of men who were working for the Corporation." He also drew attention to the fact that there is nothing new in the principle, as the 30s. minimum has for years been in operation in East Ham—which, by the way, happens to be another heavily rated place. Possibly there may be men in the employ of these two Corporations who are, or will be, envied by some of the workmen engaged on similar jobs elsewhere.

Accounts of County Councils.

The accounts of County Councils (other than the London County Council) and Joint Committees of such Councils are dealt with in Part II. of the Annual Local Taxation Returns, the volume of which for the year ending March 31, 1909, is now available. From this it appears that the receipts of the Councils (other than from Exchequer contribution accounts and from loans) for the year 1908-9, were £14,168,847; while the sum carried to the Exchequer contribution accounts was £3,973,776. The expenditure not defrayed out of loans (but including loan charges) totalled £16,744,122. The amount paid on account of loan charges was £1,398,880; the loans outstanding at the end of the period under review being £19,189,581. The total expenditure in respect of the year 1908-9, not taking into account expenditure in respect of elementary education, exceeded the expenditure of 1904-5 by £1,161,598. The total increase, inclusive of the expenditure on elementary education, amounts to the sum of £2,623,932. Of this, £261,110 is represented by increased expenditure on main roads. The expenditure on higher education was £546,633 more in 1908-9 than in 1904-5—representing an increase of 50 per cent. The annual charges of the debt of the Councils, &c. (repayments of principal otherwise than out of sinking funds or redemption funds, payments to sinking, &c., funds, and interest and dividends), for purposes other than education, amounted in 1904-5 to £504,098, and in 1908-9 to £707,959. The total expenditure out of loans increased from £1,468,800 in 1904-5 to £2,017,981 in 1908-9—an increase of 37 per cent. This increase is due to expenditure for purposes of education, small holdings, and main roads. The expenditure out of loans for other purposes decreased from £1,084,462 in 1904-5 to £467,770 in 1908-9—*i.e.*, by 57 per cent. The total amount raised by the Councils on loan during 1908-9 was almost equal to the sum raised in 1907-8, which was larger than in any of the preceding three years. The amount of outstanding loans increased between March 31, 1905, and March 31, 1909, by £4,578,615. Deducting from the totals the outstanding loan debt on account of education, the total amount outstanding is shown to have increased in respect of other matters from £7,758,265 to £9,809,329, or 26 per cent., between 1904-5 and 1908-9. In the same four years, the amount of loans outstanding in respect of county bridges increased by 16 per cent. On account of light railways, the outstanding debt was £581,516 at the end of 1904-5; and it had risen to £1,794,944 by March 31, 1909. The average rates in the pound on the total assessable value of the counties have risen since 1904-5 from 11·7d. to 14·9d. for general county purposes, and from 10·7d. to 13·1d. for special county purposes.

Paying for a Strike.

The colliery disputes in the Rhondda and Aberdare Valleys have, of course, been disastrous to those directly concerned in them; nothing else could have been expected. But, as the disturbances some time ago showed, the effects of the trouble were bound to be felt over a wider circle than that which includes the participants themselves; and now there is some evidence of the cost to which the county is to be put. An increase of 3d. in the pound in the rates levied by the Glamorgan County Council is largely explained by the fact that there has been an addition of between £20,000 and £30,000 to the police expenditure, due entirely to the colliery disputes referred to. In this is included a sum of £5000 which it is anticipated the county will have to pay in satisfaction of claims for damages which have been sent in. This increase in the rates is doubly unfortunate when it is considered how many people in business have suffered heavy financial loss in consequence of the curtailment of the spending-power of the miners. The question, too, has other aspects, each of which should do something to turn public opinion in South Wales more than ever against the strike policy. In the first place, owing to policemen having been drafted into the strike areas from all the neighbouring districts, the offenders against the law in these districts were not brought to book in such numbers as would have otherwise been the case. Then there appears to be some argument as to where the liability rests for the cost of the Metropolitan Police, who were dispatched in strong force to the scene of the rioting. The Council have been advised that the county is not legally responsible for the outlay that was incurred in this way. But, nevertheless, the Government do not exhibit any great haste to discharge the obligation. While the point is thus left open for discussion, payment is withheld from those persons who provided board and lodging for the police; and the consequence of this delay, one member of the Council pointed out, is that many men in the valleys are on the verge of financial ruin. There is a great deal to be said in favour of his contention that where the police had been forced upon these unfortunate people, the Council ought to devise some means by which they should be paid. Altogether South Wales has furnished an excellent example of how industrial disputes should not be settled.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 871.)

THE Stock Exchange has not had quite so good a time as it had last week. Various causes contributed to produce this state of things—some domestic, and some foreign. Reaction from the recent rise in home securities and the usual realization of profits sent prices down; and the apprehension of difficulties in the Far West was now supplemented by some threatening clouds in the Far East. But a cheering point was the firmness of Consols, undepressed by the large Indian issue. Monday opened quite bright; but later on this was dashed by the receipt of Mexican news. Government issues receded. Consols closed $\frac{1}{8}$ lower, and Rails gave way. But the Foreign Market was fairly calm. On Tuesday, the tendency was rather dull until near the end, when it brightened. Gilt-edged were scarcely as strong, though Consols held firm. Rails fell at first, and then recovered smartly. Wednesday was alarmed about Eastern affairs, but steadied on finding Continental bourses calm. Rails were cheered by good traffics; and Americans were quite bright. Thursday was rather quiet and irregular. Consols moved down $\frac{1}{8}$, and American dropped. In the Miscellaneous Market, there was animation in Omnibuses and Rubber. Friday was quiet, and many prices were depressed by realizations. Consols recovered $\frac{1}{8}$. Saturday was not a brilliant day, and weakness prevailed in many quarters; but Consols were firm and unchanged. The Money Market was subject to some fluctuations of sharp demand and none at all; but discount rates continued to become easier. Business in the Gas Market was pretty brisk. Some issues were active; and the general tendency was very firm, with scarcely any change from the closing quotations of the week before. In Gaslight and Coke, the ordinary was largely dealt in; and all transactions were within the old limits of $105\frac{1}{2}$ and $106\frac{1}{4}$. The secured issues were fairly active; the maximum making from 85 to $86\frac{1}{2}$, the preference from $101\frac{1}{2}$ to $102\frac{1}{4}$, and the debenture from 80 free to 81. South Metropolitan also changed hands within the same limits as the week before—$119\frac{1}{2}$ to $120\frac{1}{4}$. The debenture realized 80 and $80\frac{1}{4}$. In Commercials, there were dealings in the 4 per cent. at from 114 to $114\frac{3}{4}$—a rise of 1. Among the Suburban and Provincial group, Bournemouth "B" was done at $16\frac{1}{4}$, Brentford new at from 197 to $198\frac{1}{2}$, ditto debenture at $99\frac{3}{4}$ and 100, Brighton original at 216 and $217\frac{1}{2}$, ditto ordinary at 158, British at $44\frac{3}{4}$, Ilford debenture at $97\frac{3}{4}$, and South Suburban at from 119 to $120\frac{1}{2}$. On the local Exchange, Liverpool "A" was marked at 215 (a fall of 1), and ditto "B" at 163. In the Continental companies, Imperial was firm at from 191 to $192\frac{1}{2}$, European fully-paid was done at $26\frac{1}{4}$ and $26\frac{3}{4}$, and ditto part-paid at $19\frac{3}{4}$ and $20\frac{1}{8}$. Among the undertakings of the remoter world, Bombay new changed hands at $5\frac{1}{8}$, Cape Town at $4\frac{1}{2}$, Primitiva at from $7\frac{3}{4}$ to $7\frac{15}{16}$, ditto preference at from $5\frac{1}{4}$ to $5\frac{13}{32}$, ditto debenture at $97\frac{1}{2}$, and San Paulo at $15\frac{7}{8}$.

Obituary.

The death occurred last Friday, at Bellefields, Englefield Green, in his 85th year, of Mr. JOHN GILES PILCHER, who was for nearly twenty years a Director of the Commercial Gas Company. Deceased was a Justice of the Peace and a Deputy-Lieutenant for the county of Surrey.

Personal.

Mr. WILD, who is at present assistant to Mr. J. G. Tooms, of Waterford, has been appointed Manager of the Skibbereen Gas-Works—a position recently advertised in the "JOURNAL."

Mr. W. WILLIAMSON, Gas Manager at Oban, has been appointed Manager of the Penicuik Gas Company, in succession to Mr. W. Young, resigned. Mr. Williamson is a native of Leven, and received his training in the gas-works there.

At the close of the business at the annual meeting of the Shotley Bridge and Consett District Gas Company last Friday week, several of the shareholders offered their congratulations to the Chairman, Mr. WILLIAM AYNSLEY, J.P., on the completion of 31 years' service as a Director (eleven years of which he has occupied the chair), and he was presented with a piece of valuable silver plate in recognition of his past efforts in furtherance of the interests of the Company. Mr. Aynsley expressed his appreciation of this kindness, and thanked the donors for their gift.

The Vacant Directorship of the South Metropolitan Gas Company.—As already announced in the "JOURNAL," a special meeting of the South Metropolitan Gas Company is to be held on Thursday for the purpose of electing a Director in place of the late Captain Heathorn. We learn that the only candidate for the position is Mr. Frank H. Jones, M.Inst.C.E., son of Mr. H. E. Jones, and in practice as a Consulting Engineer at Westminster.

Mr. Ernest Bury's Paper on Bye-Product Coke-Ovens.—In the last number of the "JOURNAL" (p. 754), an extract was given from an interesting paper, on "The Bye-Product Coking Process and its Future Development," recently read by Mr. Ernest Bury, of the Skinningrove Iron-Works, before the Cleveland Institution of Engineers. It was intended to give in to-day's issue a fuller notice of the paper; but we regret that, owing to the crowded state of our columns, we are compelled to hold it over till next week.

ELECTRICITY SUPPLY MEMORANDA.

Imagination a Curse—Old Cerebral Tenants—The Battle for the Shop Fronts—Publicity—Experiences of Metropolitan Electricity Supply Companies—Faults and Failures.

"WANT of imagination is to-day," said the Dean of Norwich in a sermon just recently, "almost a national curse." The reverend gentleman, it is plain, does not know the moving spirits in the electrical profession, nor has he come across the work of the Electricity Publicity Committee, and some of the advertisements of makers of metallic filament lamps. If Dr. Wakefield's knowledge extended to the advertising dodges and statements of the electrical industry, he would be quite inclined to agree with us that the possession of too much imagination may also be a curse. He would find out how well up in the production of fiction our electrical friends are; and how well versed they are in all the titbits of ancient literature bearing upon the evils and shortcomings of gas. The imagination of our electrical friends has discovered that—though for lighting purposes a much smaller quantity of gas is required now than in the days of flat-flame burners, and though the gas is now used in bunsen burners—the fumes from the combustion of gas are poisonous and life-destroying to a perfectly alarming degree; so much so that one electrician who has got a few stages worse than the majority of his fellows, has suggested that gas ought to be sold in coloured bottles, labelled "Poison." We are sorry to have to produce illustration to show the fallacy of the statement of the Dean of Norwich; but surely he cannot want a better instance than that of the fine point and keenness to which electrical imagination has been developed. Then it is found that their highly developed imagination has discovered that gas requires much more air for its complete combustion than the theoretical quantity—so much, in fact, that there is some danger of the supply running short. It has also been ascertained by electricians that since electricity distribution commenced, gas has turned very offensive, and produces much more carbon dioxide than formerly, and of a much worse brand than that produced by certain functions of the human system. It has also been brought to knowledge, by the exercise of electrical imagination, that the human race is degenerating far more rapidly than in pre-electrical days, owing to the increasing use of gas, and despite electricity having come as a corrective. The dizziness that people are observed to be suffering from as one walks along the streets is, asserts electrical imagination, traceable to the gas-saturated air they have been swallowing. It is also electrically imagined that the efficiency of incandescent gas-burners is no better, after use for an hour or two, than that of flat-flame burners; further, that the heat units produced by the combustion of gas for heating purposes have an irrepressible fancy for chimney flues, and for playing such pranks as escaping through packed cooker casings. Yet the Dean of Norwich says that the want of imagination is a national curse! Did he only know what we know, or should this note meet his eyes, he will be considering the possibility of conducting a series of mission services for the special behoof of the electrical profession.

The old assumptions that were long since welcomed, and given a permanent tenancy in the minds of our electrical competitors, have got so settled in their cerebral abode that we are afraid they will remain there as long as the present electrical workers and champions exist. The next generation of electricians may be wiser, and may be even tempted to laugh at the foibles and follies of their predecessors. The "Electrician" has been writing on "Long-Hour Loads and Tariffs"—in the main bringing out for an airing some old information about the "telephone" system of charging, fixed lamp charges, and so on. But in its opening lines, it bemoans the fact that long-hour lighting consumers in shops are the last to adopt electricity as an illuminant. The writer of the article has been walking through some of the main thoroughfares of London, and has been duly impressed with the fact that the shops that only require electricity for a comparatively few hours in winter and hardly at all in summer have been among the first to adopt electricity for lighting; while those—such as public houses—that require lighting for long hours, still retain gas. There is nothing surprising in this. It merely shows a commendable prudence on the part of the long-hour lighting shopkeepers, although the electricity suppliers would no doubt be very pleased to make a secret bargain with them for a supply of electricity at below the ordinary rates. It is a question of economy with these long-hour lighting consumers, a question of safety, and a question of reliability. We have noticed several electrically lighted shops in London that have been overhauling their gas-fittings of late. In one large emporium that the present writer was in recently, he observed that the gas-fittings side by side with the electrical ones had recently been brightened up, and fully equipped apparently ready for an emergency; and, on a suave inquiry as to why this was, the counter-hand laconically replied "once bitten, twice shy." Smiles passed; no further words were needed. The "Electrician" goes on to say that "there are reasons, other than cost—such as considerations of health, cleanliness, safety from fire, the dressing of windows, and the fact that electrical fittings lend themselves to effective illumination"—for the adoption of electric lighting. There we have some illustrations of the grotesque assumptions to which the present-day electricians have given a permanent tenancy. The injury-to-health bogey of the electricians is hustled by experience out of every house in which gas is used; and after all that has happened, it might well be imagined that at least the

"safety from fire" fiction of electricity would have been disestablished. "The first cost of the installation and preconceived ideas as to the comparative cost of electricity and gas are the usual reasons," adds our contemporary, "why electric lighting is not adopted. With these reasons, we are not at present concerned." Just so!

Touching this question of shop lighting, it was pointed out in our editorial columns last week how the electrical people have become positively disturbed over the rapid march in favour of parade lighting on the high-pressure gas system; and they are trying to move heaven and earth to stem its progress. Some time ago the electricians in and about London were working on the system of co-operative shop front lighting with flame arc lamps. But they did not meet with a great deal of success. And some of the installations of which we have knowledge look to-day as though the lamps sadly require renewing. But where the electricians met with a discouraging amount of success in times past, the gas companies with the high-pressure inverted gas-lamps are now doing marvellously well; and the revelation has so astounded the electricity suppliers that they are putting forth fresh effort to try to counteract the success of their competitors in the provision of cheap, high-power, steady light. The excitement of the Islington Borough Council Electricity Department over the success in this direction of the Gaslight Company has been alluded to in previous issues; and, looking across the Thames, the striking installations by the South Metropolitan Gas Company of parade lighting by high-pressure lamps in Streatham, Lewisham, and other parts have caused the local electricity suppliers to bestir themselves—especially the South Metropolitan Electric Supply Company, who have been particularly hard hit by both the South Metropolitan Gas Company and the South Suburban Gas Company—by the latter through their success in getting the lighting contract through high-pressure gas for the Festival of Empire Exhibition, as well as the contract for the provision of gas power for generating electricity for the great show. We took a favourable opportunity last week to go and make an inspection of the high-pressure parade gas lighting between Streatham and Streatham Hill; and it is a brilliant display—the measure of adoption showing how thoroughly the shopkeepers have welcomed the high-power inverted gas-lamps. We see there shop fronts lighted by this means that were formerly illuminated electrically, and several shops that are lighted internally by electricity are now lighted externally by gas.

The Bermondsey Borough Council are having a shot for an installation of parade lighting for some tradesmen in the Southwark Park Road. But it is not going to be a very profitable affair for the Council, if the scheme is accepted. It appears that the cost of providing twenty arc lamp posts, &c., will be £265; while the annual income from the twenty lamps at £5 10s. each will be £110. The annual cost of carbons and maintenance is estimated at £25 10s., which is remarkably low if it includes carbons, labour, maintenance, and depreciation. Then it is computed that the number of units to be consumed will be 7020 per annum. We have no information as to the power of the lamps nor of the number of hours that the lamps will be running per annum. But the average consumption per lamp is put at only 351 units per annum. The charge for the electricity is suggested at 2d. per unit, which amounts to £58 6s. 8d. That is to say, current and carbons and maintenance will absorb £83 16s. 8d.—leaving only £26 3s. 4d. for interest on, and replacement of, the £265, and we rather think, for labour.

The proposals for a special electricity advertising campaign in London by the electricity supply authorities, in conjunction with the Electric Supply Publicity Committee, appear to be taking root. A conference of the supply authorities have unanimously confirmed the Executive Committee's recommendations, which include the raising of a special fund of about £1500 for advertising, including an extensive display of large-size posters on the principal hoardings throughout London. A scale of contributions has been prepared, ranging from £10 per annum where the gross revenue of the undertaking does not exceed £10,000 per annum to £60 where it exceeds £75,000. It is noticed that the Borough Engineer of Woolwich has been authorized by the Council to expend £32 on the purchase of leaflets, pamphlets, &c., during the ensuing year, and a similar sum upon posters. Succeeding paragraphs may show some reason for the supplementing of effort in stimulating business, and other reasons may be extracted from a little consideration as to the competition of the gas companies.

In the "Memoranda" last week, reference was made to the metallic filament lamp effects upon the fortunes of the London Electricity Supply Companies, and to how, notwithstanding the economy of these lamps compared with the carbon filament variety, painful is the task of getting fresh business for lighting, though householders are being constantly reminded that they are slowly killing themselves and their families by retaining the use of gas lighting. But the killing process is so slow that householders do not appear to mind it a little bit. That, however, in passing. After reading through the several reports of the London companies, a few points in them (other than the one regarding metallic filaments) are found to have made impression. So far as the companies' receipts are concerned, two or three have obtained increases; but generally they are marking time in this respect. There are, however, some of the undertakings that are better off in regard to profits. But this is due mainly to a reduction of expenses; and one cannot tell in this connection in all cases, from the figures published in our electrical contemporaries, how matters stand in respect of maintenance and depreciation. While, however, the sale of current for lighting has practically stood still (the Westminster Company, as was shown last week had a bad setback in the demand), most of the companies have an increased power output; and this, in turn, has again automatically brought down the average price received per unit. There is hardly a company whose average price is not lower for the past year than for the previous one. Our electrical contemporaries are sometimes inclined to sound a jubilant note over this reduction of the average price. But it does not represent an actual reduction to the consumers; and the latter may well wonder where the ground for congratulation and jubilant notes comes in. As a matter of fact, there are one or two instances where the price of current for lighting purposes has been raised; and this is the penalty the consumers in those particular districts have to pay for selecting the newer and more economical lamps on the market.

Let us look at a few points in the general results of some of the principal of the companies. Take the Charing Cross Company first. From their West-end undertaking, the revenue last year was practically the same as in 1909; while from the City undertaking there was a net increase in the earnings of merely a couple of thousand pounds. There was only an advance of 2·7 per cent. in the whole number of the lamps connected to the Company's system. The increase in the sales in the West-end to private consumers is only 1·38 per cent.; and in the City, it was 5·3 per cent.—mostly for power purposes. It is interesting to note, too, that about half the current used in the West-end is for power and heating, and half for lighting; while in the City three-quarters is for power and heating, and only a quarter for lighting. The City of London Electric Lighting Company had a decrease of £6032 in gross revenue, and of £3901 in net revenue. The units sold (25,183,380) exhibited a drop of 271,105. The power and heating supplies now equal upwards of 35 per cent. of the total units sold for private supply. The Westminster Company had an actual drop in their profits from £85,800 to £72,500; while the St. James' and Pall Mall Company exhibited an advance, from £30,600 to £32,300. But in the case of the latter undertaking had it not been for the more economical working of their plant, the profit might have shown a decline. On the other hand, the Westminster Company's working expenses went up considerably—by no less than £9100. While referring to these two Companies, it may be mentioned that the St. James' Company cut down their allowance for depreciation by £2200, and the Westminster Company clipped off £3400. The ordinary shareholders of the South Metropolitan Company are not yet in the enjoyment of dividends. As a matter of fact, there has been no considerable difference in the revenue of this Company for the past three years; and for last year the allowance for depreciation is smaller. Speaking generally, dividends are on the same lines as a year ago in the case of the majority of the companies. One or two have been able to pay a slightly increased one; but these are quite exceptions. The companies, it is further noted, have felt what the London Gas Companies experienced years ago—that competition among themselves is an uneconomical proceeding. The owners of the ordinary capital in the City undertaking of the Charing Cross Company might have been much better off if they had invested their capital elsewhere. The London Supply Corporation who compete with other concerns are only able to distribute a 2 per cent. dividend among the ordinary shareholders; and this undertaking is now being devoted largely to traction and power business. Where its area overlaps those of the Westminster and St. James' Companies, there has, with the approval of the Board of Trade, been a transfer of the business and rights on certain terms—to the advantage, it is believed, of all the three undertakings. From what has been said, it will be seen that the experiences of electricity supply in the Metropolis have been varied during the past year; and they might all, so far as the final financial results are concerned, be summed up under the two words—marking time.

There was a failure in the distribution system of the St. Pancras Electricity Department on Dec. 3. The statement of the fact thus is not intended to imply that the occurrence is an unusual one; but it is interesting in that a report by the Electrical Engineer on the event shows that the number of "faults" on the cable concerned has increased considerably of late, and there must be a large expenditure in the near future upon it. St. Pancras can hardly be an isolated instance of this sort of thing. In his report, the Electrical Engineer pointed out that the earthing of the centre wire had had the immediate effect of doubling the number of faults. There were 12 faults in 1906, 24 in 1907, and 1 in 1908; but they increased to no less than 54 in 1909, and 50 in 1910. With modern cables, experience is of a more pleasing order. But the result is that the cable on which so much trouble has occurred is to be sent to the makers for stripping and covering piecemeal—200 or 300 yards to begin with—as the work is going to represent a substantial expenditure.

Hornby's "Gas Engineers' Laboratory Hand-Book."—A third edition of this useful work is to hand, from Messrs. E. & F. N. Spon; price 6s. net. This issue is to be distinguished from the two earlier ones from the fact that a description of the method of determining the quantity of naphthalene in gas has been added; also that the chapter on calorimetry has been extended by the inclusion of the method of determining the heating value of gas by means of the Boys calorimeter,

NOTES FROM WESTMINSTER.

In a small way, the Committee work on Opposed Gas Bills has commenced; but, as remarked in our leader columns last week, now that the Gaslight and Coke Bill has fallen into the ranks of the unopposed, there seems to be precious little that will produce any particularly noticeable animation. There have been one or two gas measures before Committees other than the Unopposed Bills Committee; but it is impossible to feel yet any of the old interest that obtained a few years ago when as many as five or six good fighting gas measures were running in the rooms at the same time, and probably had to meet opposition in both Houses. We are not deploring this. It is merely pointed out as a feature of the times that formerly, session after session, had nothing to resemble it, and when day after day there was a rubbing of shoulders with the gas practitioners of Westminster, and gas men from many parts of the country. We believe in legislation being as cheap as possible, and its cheapness is contributed to not by fighting, but by diplomatic negotiation if there are points at issue. And yet somewhere behind this commonsense view of things lies a liking for a good fight. But there seems little chance of one this year. At the same time, the course of events has to be closely watched in order that those new introductions, changes, and modifications that may make an impress on gas legislation in the future may be given due prominence, and serve as guides and warnings.

Gaslight Affairs. To make the record complete in these notes, there are a few miscellaneous points to be mentioned. It was stated in the leader columns last week that the matters that were at issue in connection with the Gaslight and Coke Company's Bill, which will annex the territories and undertakings generally of the Barking and the Chigwell, Loughton, and Woodford Gas Companies, were not of great importance, and that they had been found to be amenable to friendly negotiation, without the parties coming into open contest. The Barking District Council took their cue from the West Ham Corporation opposition in 1909, when the amalgamation of the West Ham Gas Company's undertaking was before Parliament. The District Council were desirous of getting some assurance in connection with the employment for a period of gas labour in the district, and some protection of the inflow to the local exchequer from the rating of the gas-works. An understanding on the points has been arrived at; but the agreement will not be formally incorporated in the Bill. Another opponent was the Port of London Authority, who wanted to ensure that the Company would not, under the powers they sought, interfere with undedicated roads over which the authority now have, or will have, rights; and the Company have willingly agreed not to interfere without the consent of the authority. All's well that ends well; and the Company are to be congratulated upon the fact that so little stood in their path in prosecuting their expansion policy. The Bill is expected to be before the Unopposed Bills Committee on Thursday. While on the affairs of the Gaslight and Coke Company, one other interesting matter has transpired. It will be remembered the Governor (Mr. Corbet Woodall), at the last meeting of the proprietors, stated that the site of the abandoned works at King's Cross (except the portion occupied by the gasholders) had been sold to the Great Northern Railway Company, at a price the Directors considered satisfactory. According to a statement made the other day before the Committee on the Great Northern Railway Company's Bill, the price paid for the land is £55,300.

Miscellaneous. It was also mentioned in the editorial columns last week that the gas and water clauses had been deleted from the Bedwellty Bill, through non-compliance with the Standing Orders, and that the tramway provisions had been removed from the Swansea Gas Company's Bill. The Chesham and District Gas Bill was introduced to the notice of one of the House of Lords Committees last week; the satisfactory announcement being made that a little conference had produced a settlement. The form of the clauses covering the agreement was privately under consideration at the end of the week. It was expected that they would be brought before the Committee yesterday, and the question of opposition then finally disposed of.

County Councils and Pipe Work. In the past few sessions of Parliament, there have been signs that the County Councils of the country are doing their best to impose more onerous conditions on those who, by statutory authority, have the right to use the subsoil of the highways under their jurisdiction for the laying and carrying of pipes. Their ideas are getting more and more of a one-sided character. The Staffordshire and the Warwickshire County Councils have certain views on this subject that are unfair to a Company performing a public service; and we were pleased to see when these two powerful authorities appeared in opposition to the Tamworth Gas Company, that the latter resisted every point considered unreasonable in regard to their use of the roadways and the financial obligations it was sought to impose upon them. The Councils were seeking a full pound of flesh and something over; and the Committee of the House of Commons presided over by Sir Henry Samuel refused to be parties to any oppression or injustice of the character proposed. The Company are seeking to extend their area to outer districts that have offered them a hearty welcome, and have (as Mr. W. A. Sapey, the Company's Engineer and Manager showed) promised the Company a good connection for their enterprise. The County Councils took this as a favourable opportunity for pressing for more than the general law allows, and for more than the Company's legal advisers could counsel them to concede for the purpose of avoiding a fight. The Company were conciliatory wherever possible. They readily agreed to abide by any reasonable suggestion of the County Surveyors as to the positions that pipes should be laid in the roadways, they willingly promised to give seven days instead of three days' notice of proposed work, to prepare plans on a scale clearly showing their proposals, and not to interfere with any structural part of a road or bridge without previous consent of the Surveyors—such consent not to be unreasonably withheld. But then came other clauses. In one the Councils sought the right to command at any time the alteration of the position of mains and pipes (matters in dispute to be referred to arbitration) without compensation to the Company. Such a clause would have exposed the Company to unknown expenditure and unknown disturbance, after complying with all the requirements of the Councils' own officials in the first instance. But there again the Company did not regard the matter in any stubborn spirit. "There is a way of compromise," they truly said. "Give us compensation, and the power sought is yours." But the Councils would not; and their refusal is as significant as the desire to obtain a power that might (we do not say would) be arbitrarily exercised at the expense of the Company. The Committee saw the matter from the Company's point of view, and would not give the power without provision for compensation. Another matter that, if the power had been obtained, would have opened the way to considerable dispute was that the Councils wanted the Company to pay for any damage occasioned by the concentration of traffic on one part of a roadway while work was being carried on by the Company on another part. The Committee decided against the Councils on this point. The question of the depth at which pipes may be laid is another favourite one nowadays when County Councils have a *penchant* for heavy steam-rollers. They desired a clause that had a dangerous roving appearance about it, under which the Company would have been compelled to lay ordinary gas-pipes at a depth of not less than 2 ft. 6 in. and steel pipes at a depth of 2 feet. The Committee were agreed that no great harm would accrue to the Company by making the 2 ft. 6 in. depth apply to new mains, and by perpetuating the *status quo* in respect of the existing distribution system. The Councils also desired to remove from themselves all question of liability for any damage occasioned by the use of steam-rollers. They were unsuccessful. The Company are to be congratulated on the result of their resistance. The Bill will therefore proceed with little change, and will enable the Company to pursue the progressive path which they have been consistently following, within the limits of their opportunities, under present direction and management.

Slough Water Purchase. After much longing, and various attempts, the Slough Urban District Council are in a fair way of entering into possession of the Water Company's undertaking. Long years ago, the local authority cast their eyes upon it. But the matter remained dormant for a period. In 1908, they made a determined attack by promoting a Bill for compulsory purchase. The Commons Committee who considered the measure declined to pass it unless a price was fixed by agreement. The measure therefore fell through. The next year the Council set out to make another trial. The ratepayers refused to allow them to proceed. Last year the Company promoted a Bill for additional powers; and the Council and the Company agreed to a purchase clause. The former consequently came up with a Bill this session to invest them with the necessary powers. When the Bill came before Lord Newton's Committee last week, the Water Company, the Middlesex County Council, and the Eton Rural District Council were in opposition—not, it was early ruled by the Committee, on preamble, but only on clauses. The County Council wanted road protection; and they seemed to wish to ensure some sort of safeguard against the District Council taking water from the County of Middlesex. The Company agreed with the County Council to a clause last year; and the District Council naturally take over what was then stipulated. But the County Council, it was now suggested, wished to have it rigidly laid down that water taken from any well in the county of Middlesex should be used only for the supply of Middlesex. In the result, there was an agreement with the County Council; but its nature has not yet transpired. With regard to the appearance and submissions of the Water Company, the Committee decided that the undertaking for purchase purposes should not include cash in hand other than consumers' deposits and at the Company's bankers. The Company were also allowed their costs of appearing before the Committee. The Eton Rural District Council objected to the Slough Council making profits outside their own administrative area, and devoting them to purposes within their area. The Rural Council were rewarded for their appearance with a clause making the charges uniform throughout the area, excepting that for water supplied above 140 feet level an additional charge of 25 per cent. may be made. If the District Council are able to reduce the charge for water, the reduction is to apply to the Eton area as well as to Slough. This seems to follow on the previous decision without special provision. However, with these agreements it may be taken that the Bill will now proceed without molestation from any quarter.

Eastern Counties Bills. The Ipswich Corporation Bill have been before the Local Legislation Committee. One section of their measure refers to water supply, in regard to

which the Corporation have come to the end of their resources; and they are a little bit anxious about sea water getting drawn into the present wells. This has not happened yet; but the water is being carefully watched. The Corporation have been fortunate in finding an excellent source of supply at Whitten; and it is considered likely, judging from the trials made, that some 3 million gallons of water per day will be obtained from this new source. In such high opinion is it held that the possibility is being considered of in future concentrating the whole of the water supply at this place. The estimate for the works at present contemplated is £21,000, with an additional £5000 for extensions of mains. Mr. William Matthews and Mr. C. W. S. Oldham, the Corporation Water Engineer, were among the witnesses. The Committee gave their ratification to the proposals. The Felixstowe and Walton Water Company's Bill, which proposes (among other things) extensions of the works, has reached the unopposed state through agreement; and it has been before the Unopposed Bills Committee—passing satisfactorily through its examination.

A GAS TEXT-BOOK FOR STUDENTS.*

This well-known work, now in its sixth edition, has been very much enlarged, and is produced on an altogether larger scale than that familiar to readers of the earlier editions. This was found necessary, owing to the extensive developments which have taken place in the process of gas manufacture, especially in those relating to the retort-house. In his preface, the author states that the book is intended for students preparing for the examination of the City and Guilds in Gas Engineering; and this being so, it is not intended to be an exhaustive treatise on the subject. For the purpose named, the work is an ideal one, though there are some notable omissions. Just sufficient is included to enable the student to get a thorough grasp of the subject; and unnecessary matter of an argumentative nature, such as is not required for a book of this description, is rigidly excluded.

The volume contains 420 pages, and is divided into 22 chapters and an appendix, in which specimen examination papers in Gas Manufacture of the City and Guilds of London Institute occupy the lion's share of the space. In an introduction, the author gives a brief outline of the process of gas manufacture, illustrated by a frontispiece showing the apparatus required. The writer remembers well how useful he found this illustration in one of the earlier editions in his student days. Here it is stated that coal is placed in the retort in charges of from two to four hundredweights, and is allowed to remain therein from four to twelve hours. This is hardly correct, for where twelve-hour charges are in vogue, the charges are never so small as four hundredweights. In giving a few and scanty particulars of the size and shape of the retorts in general use, the author mentions that the ⏛ shaped retort 20 in. by 13 in. is a very useful size, while 24 in. by 16 in. is a convenient size where stoking machinery is employed. With this statement it is impossible to agree, for the former is distinctly small for any but the smallest works, while the latter is very large indeed, and is rarely seen. ⏛ shaped retorts, 21 in. by 15 in. and 22 in. by 15 in., are much more common, and are, too, much more convenient in working. The author is also rather misleading in limiting the advantages of the through retort to (1) smaller accumulation of carbon, (2) the current of air through the retort loosening the carbon, and (3) more heating surface being available for the same expenditure of fuel. It is inexplicable that no mention is made of the real and substantial advantages of the through retort in all but small works.

In an excellent chapter on carbonization, the author gives a description of the construction and working of retort-settings, and briefly the use of pyrometers. It is noticed that, though many types of retort-settings are described and illustrated, the popular setting of ten retorts set in two vertical rows is omitted.

The functions of the hydraulic main and details of the Dillamore tar-tower are explained in Chapter IV. Under the heading of "Labour-Saving Appliances in the Retort-House," most of the latest machines and the various systems of vertical retorts are described and illustrated.

In the two chapters on the "Effects of Temperature in Modifying the Quantity and Quality of Gas Produced," and the "Effects of Temperature on Residuals," much information is given showing the effect in working small charges at different temperatures. The question of the importance of the heavy charge and its effect on the quantity and quality of gas and the production of residuals is almost entirely ignored, with the exception of a couple of short paragraphs. The author has unfortunately neglected to bring the volume up-to-date in this respect; and a question on this subject in the City and Guilds Examinations would leave quite in the dark the student who relied entirely on this volume. The advantages of the heavy charge and its effect on the finances of scores of undertakings during the past year are so very substantial that the reader of Mr. Hornby's work (published though it is in 1911) will notice that this matter is practically ignored.

In a chapter on exhausters, several excellent illustrations are given. From these, the construction and working of this apparatus may be very readily grasped. This is always a difficult matter to the student; but a careful study of this chapter should make it quite clear. It is noticed that the author, in explaining the necessity of governing the speed of the exhauster to allow for the variation in the production of gas, states that the plan generally adopted is to bye-pass the gas from the outlet to the inlet of the exhauster. Surely this old and wasteful method is not the "plan generally adopted." In all but old-fashioned works this has given way to some system in which the steam-valve of the engine is governed by the production of gas.

The purification of gas, which subject is divided into the three sections—condensation, abstraction of ammonia, and the elimination of CO_2, SH_2, and sulphur compounds—is well treated, especially that on "ammonia." The author, in giving the impurities in coal gas at the outlet of the condensers, states that ammonia is present to the extent of 476 grains per 100 cubic feet, or 1·5 per cent. by volume. This can hardly be correct. If so, it would mean that 100 cubic feet of gas contained in all some 700 grains including that condensed in the retort-house. This would result in an approximate yield of 66 gallons of 8-oz. liquor per ton of coal carbonized, as against 35 gallons in common practice. In contrast to the author's figure of 476, Butterfield gives 200 to 300 grains as the quantity of ammonia present in coal gas at this stage of the process (outlet of condensers). In discussing the question of using boards or coke in scrubbers, the author states that where coke is used the scrubber will require renewing at least every second year. This may be the case in some works where the condensing plant is deficient and allows much tar to pass forward; but the writer's experience with four scrubbers filled with coke is that they will last for many years, and then only throw ½ inch of back-pressure. A somewhat notable omission in the chapter on dry purification is any mention of the hurdle grid. This type of grid is almost universally acknowledged as being superior to the horizontal grid, though it has by no means been generally adopted. The cause of this is, however, the fact that purification with oxide, even with horizontal grids, is carried out so cheaply that engineers do not consider it worth while to scrap the old type and adopt the new, except in special cases where back-pressure is a source of trouble. More might have been made of the subject of pressure and exhaust, especially as nowadays several excellent types of registers may be had, showing exact reproductions of variations at any time during day or night. One type of a very massive construction is illustrated; but it is hardly suitable for the many positions in a gas-works where such registers may be most advantageously placed.

The "Practice of Photometry" is a good chapter. Other subjects which are adequately treated are the "Gasholder and its Tank," "Methods Employed for Controlling Pressure (Governors)," "Laying of Mains and Service-Pipes," "Construction of Gas-Meters," "Gas-Burners;" also the influence of "Temperature and Pressure upon the Volume of Gas," and the "Composition of Coal Gas." In each case the subject is dealt with in a comprehensive manner, and gives all the necessary information required by the student.

In a chapter on the "Enrichment of Coal Gas," the manufacture of carburetted water gas is explained, as is also, though briefly, the making of oil gas and the carburetting of gas by spirit vapour. It is somewhat old-fashioned to describe the process of making carburetted water gas under the heading of "Enrichment." In these days of 14-candle power gas, as tested in the No. 2 "Metropolitan" burner, coal gas needs no enrichment; and in these cases the water gas made is merely so much more gas of an equal illuminating power.

Taking the volume as a whole, it is much improved since the last edition; and, with the exception of a few omissions, there is little of importance to criticize. It is clearly written and well illustrated throughout, and covers the whole range of the subject required for the examinations on Gas Manufacture. For this purpose, it will be found most useful; and Mr. Hornby is to be congratulated.

* "A Text-Book of Gas Manufacture for Students." By John Hornby. Sixth edition, revised and enlarged. London: G. Bell and Sons, Ltd.; 1911.

Calorific Power Standard for Paris Gas.

In view of the changed conditions of gas supply consequent upon the general adoption of the incandescent system of lighting, and the more extended use of gas for culinary and heating purposes, a decision was come to by the Paris Municipal Council, towards the close of last year, to abolish benzol enrichment, which had cost the city between £32,000 and £36,000 annually, and adopt a calorific test for gas in place of the test for illuminating power by the Dumas and Regnault photometer, which has been in force ever since the establishment of the old Paris Gas Company in 1856. When writing on the subject for the current number of the "Journal de l'Eclairage au Gaz," M. Grebel expressed the hope that the calorific power standard would be fixed at something between the equivalent of 555 and 550 B.Th.U. gross and 511 and 462 B.Th.U. net per cubic foot. It appears that the minimum has been settled at 522 B.Th.U. per cubic foot net, which would correspond to about 566 B.Th.U. gross.

"Distribution by Steel."—We have received from Messrs. John Allan and Co. a work bearing the above title, the joint production of Mr. Henry Woodall, M.Inst.C.E., and Mr. B. R. Parkinson, A.M.I.Mech.E. The book deals with main-laying exclusively by steel tubes; and the text is illustrated by reproductions of many photographs of work in progress, as well as by diagrams and tables. There is a useful chapter on the testing of low-pressure gas-mains for leakage; and also an index. The book is bound in cloth; price 6s. net.

INSTITUTION OF GAS ENGINEERS.

Provisional Programme of the Annual Meeting.

We have received from the Secretary (Mr. Walter T. Dunn) a copy of the circular which, by direction of the Council of the Institution of Gas Engineers, he has issued in regard to the forthcoming annual meeting, arrangements for which are in progress. In acceptance of the invitation of the Corporation of Glasgow, and in accordance with the resolution passed by the members at the meeting last year, it will be held in Glasgow from the 13th to the 16th of June, under the presidency of Mr. Alex. Wilson, the Corporation Gas Engineer. The following is an outline of the programme as at present proposed.

On the first day, the members will be welcomed to the city by the Hon. A. M'Innes Shaw, the Lord Provost, at 10.30 a.m. The rest of the morning will be occupied, as usual, with the delivery of the President's address and the reading and discussion of papers. On the 14th, technical matters and the annual general meeting of the donors and subscribers to the Benevolent Fund will occupy the members in the morning; and the afternoon will be devoted to visits to works. In the evening, there will be a reception and dance in the Banqueting Hall of the City Chambers, on the invitation of the Lord Provost and the Convener and Members of the Gas Committee of the Corporation. On the 15th, the business will be brought to a close in the morning; and subsequently the members will visit the Scottish Exhibition of National History, Art, and Industry, where, on the invitation of the President and Mrs. Wilson, they will take afternoon tea. On the 16th, there will be a steamer excursion on the Firth of Clyde. The invitations relating to the reception, the visit to the exhibition, and the excursion will be extended to ladies.

Members having communications to offer for reading and discussion are requested to send particulars not later than the 31st inst. for submission to the Council.

With regard to travelling facilities, it is expected that the Railway Companies throughout the United Kingdom will again grant to members attending the meeting the privilege of tickets at the rate of a fare-and-a-quarter for the double journey, on presentation of the Institution's voucher when booking.

In the concluding paragraph, attention is called to the Benevolent Fund; and, in the name of the Committee of Management, a strong appeal is made on its behalf. It is pointed out that much good work is being done, by means of the fund, in affording help to necessitous members, widows, and orphans; but the Committee regret that, owing to insufficient funds, they have been unable to deal with all the applications as received.

NATIONAL PHYSICAL LABORATORY.

In accordance with the announcement which appeared in the "Journal," the President of the Royal Society, as Chairman of the General Board of the National Physical Laboratory, held the annual reception of visitors at Bushey House, Teddington, last Friday, when the various departments of the establishment (of which Dr. R. T. Glazebrook, C.B., F.R.S., is the Director) were open for inspection. In the several rooms were to be seen appliances of all kinds connected with investigations in the realm of physics; but those in which members of the gas industry are specially interested were to be found in the Thermometry and Electrotechnics Divisions. With the former, Dr. J. A. Harker, F.R.S., whose recent lecture at the Manchester University on "Pyrometry" was given in the "Journal" last week (p. 772), is associated; and there were on view a gas thermometer serving as an ultimate high-temperature standard to 1200° C. (2200° Fahr.), a Callendar-Griffiths resistance bridge, of the latest pattern, with Collins mercury contacts, Callendar recorder, and other instruments. One of the rooms contained baths for the verification of working standard high-range mercury thermometers, resistance thermometers, and pyrometers. In the new electric furnace room were to be seen apparatus for attaining temperatures up to 3500° C. (6332° Fahr.), radiation furnaces for the verification of pyrometers, and a high-pressure gas injector furnace for testing refractory materials. In the Electrotechnics Division, with which Mr. C. Clifford Paterson is associated, the visitors had an opportunity of inspecting in the standards room a 13-feet photometer bench, and in the large photometer room a long track for testing arc lamps, and a bench for testing pentane lamps. In a room in which life-tests of glow lamps are carried out was shown a 10-feet photometer bench, with lamp spinner and table for measuring the candle power of lamps under test.

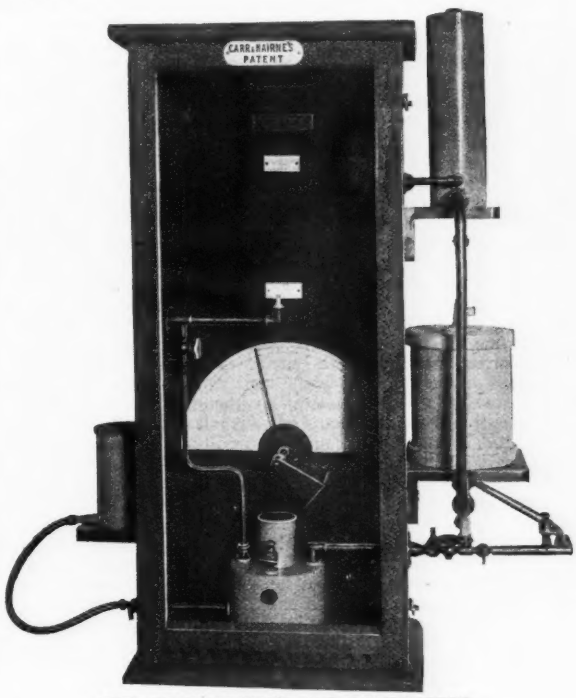
An interesting feature of the Laboratory is the experimental tank, the building for which is now complete, and the special equipment well advanced. There are two water-basins; the larger one being 550 feet long, 30 feet wide, and 12 ft. 3 in. deep, and the smaller one 58 feet long, 5 feet wide, and 3 ft. 3 in. deep. The larger tank is provided at the north end with docks for storage, arranged to give easy access to the models, and at the south end with a shelving bench to counteract the waves formed by the models. At the north end of the smaller tank is fixed a rotary pump which will enable model experiments with flowing water to be made. For those made with still water, pits 16 feet deep have been constructed on the middle line at each end of the tank.

THE WANDSWORTH JET.

Anything emanating from the source of "The Cheapest Gas in London" is worthy of attention; but when we have brought before us a piece of apparatus which is an integral part of the system of the Wandsworth and Putney Gas-Works, and which may possibly let us into the secret of "How it is Done," then the subject is one of absorbing interest to gas-works managers.

When one finds that Messrs. Carr and Nairne's [Mr. H. O. Carr, the Engineer of the Wandsworth and Putney Gas Company, and Mr. U. O. S. Nairne, the Chief Chemist] new invention is nothing more nor less than an ingenious development of the old-fashioned jet photometer, a good many of the older gas managers who have remained faithful in their allegiance to the instrument which in past years has been of such inestimable value, will wonder why Messrs. Carr and Nairne's idea did not occur to them years ago. It is true that in some works there has been a lingering idea that the jet photometer might be utilized in the way in which it is being used at Wandsworth; but circumstances of gas making have really only recently produced such exigencies as to render it worth while to devote long and patient experimenting to the subject.

Messrs. Carr and Nairne have apparently made it an article of faith that the moment gas leaves the hydraulic main its illuminating value as a "finished gas" shall be known, and that the knowledge as to it shall not be intermittent but instantaneous and constant.



THE WANDSWORTH JET PHOTOMETER.
Carr and Nairne's Patent.

Many engineers have fitted a purifier to the jet photometer, and used it on crude gas, with the idea of arriving at the point which has meant such success to the Wandsworth and Putney Gas Company. The true inwardness, however, of the point to be arrived at does not seem have occurred to anyone till now. Experimenting alone could provide the key to the puzzle of the exact areas and disposition of the jet photometer which would answer the demand of modern gas making; and Messrs. Carr and Nairne have apparently expended their labours in a direction which will repay the shareholders of the Wandsworth Company many thousandfold.

As has been stated, the object aimed at has been to provide means by which the working of the exhausters may be guided entirely by the illuminating power of the finished gas; and this is effected by using a small float pressure gauge with practically no gas capacity, a shorter jet than usual, a water-cooled condenser, and an oxide purifier—all combined in the one instrument, with sensitive regulating cocks and quadrants divided in such a way as to enable adjustments to be made suitable to any quality of gas. Crude gas can be supplied to the instrument, and is purified and burnt with the same facility as if the jet photometer were connected direct with the town gas. A reading may be made for illuminating power in terms of the No. 2 "Metropolitan" burner, or in terms of the No. 1 "London" argand; while by a secondary divided circle these readings can be made to hold good for carburetted water gas and for mixtures with coal gas. The observer may read the instrument with the confidence that he is getting the correct indication of the value of the gas which has just left

the retorts, or he can, by turning on a tap, bring in the town gas. With a little extra pipe-running he can also test the carburetted water gas or mixtures. The adjustment of the water-line, the lighting of the jet, and all manipulation are effected from outside the case. The value of this will come home to every gas manager who knows what valuable time is wasted when it is necessary to open the door of the jet in order to ascertain the accuracy of the water-line. It takes several minutes for the freshly-lighted flame to assume steadiness, on account of the disturbances of the air currents by the mere opening of the door. All this difficulty is obviated in the Carr-Nairne patent jet; and the door of the instrument need not be opened until a considerable change in the percentage of water gas has affected the specific gravity in such a manner as to render it necessary to turn the quadrant pointer to a new percentage.

The instrument is found to be extremely sensitive; the pointer moving about 1¼ inches per candle on the scale, whereas with most jets ⅜-inch is the largest space devoted to one candle.

Messrs. Carr and Nairne are now working on a simple apparatus which will enable the photometer to be used on a suction-main, as at present those in use have been connected to the pressure side.

The following is a brief description of the apparatus made under the Carr-Nairne patent: The crude gas is first of all passed through a tubular condenser in which the gas is cooled by a continuous stream of water circulating round the tube or tubes through which the gas is passing; the condenser being fitted with a drain-off pipe, from which condensed matter may be run off occasionally from the chamber at the base. The gas, after passing through this condenser, enters a small purifier or purifiers (in the case of the coal gas, one is sufficient) charged with suitable material, and likewise furnished with a drain-off pipe. The purifier is provided with a burner or blow-off on the outlet pipe, to quickly clear it of stagnant gas. The gas is then passed through a regulating tap (which admits of very delicate adjustment) to the photometer. At the inlet to this regulating tap, a connection can be made, so that clean gas may be tested without passing through the condenser and purifier. In this way, the same apparatus can be used alternately on clean or foul gas. In cases of very variable pressure of the gas to be tested, a pressure governor is fitted on the outlet to the purifier. The gas then enters the chamber of the jet-flame portion of the apparatus, which is so constructed that a very small alteration in the quality of the gas will cause quite an appreciable alteration of the dial-hand when the height of the jet-flame is regulated to the correct height. The tube leading to the jet-nozzle can be fitted with a quadrant tap, so that gas of any specific gravity may be tested by first moving the quadrant pointer to the corresponding specific gravity—marked empirically on the graduated quadrant. The whole apparatus is made of materials suitable to the gas to be tested, to withstand corrosion, &c.; and all passages and chambers are of as small a capacity as possible for practical use. This promotes rapidity of testing, due to the small amount of gas necessary to clear out the apparatus.

The jet photometer is enclosed in a case with a glass door in front; and after its first adjustment the apparatus can be used without opening the door—thus avoiding temporary alteration of the conditions of combustion of the gas—as the case is fitted with a sliding cover over a small hole for lighting purposes; and the water-level in the chamber can be regulated by the water vessel and tap which are outside the case. With testing apparatus of this description, retort-houses can be efficiently controlled, and any uneven or irregular makes of gas avoided.

Messrs. Simmance and Abady are the licensees for the apparatus, which is being manufactured by Messrs. Alexander Wright and Co., of Westminster Palace Gardens, Victoria Street, S.W.

Steel v. Cast Iron for Boilers.

We have received from Messrs. Robert Jenkins and Co., of Rotherham, some particulars in regard to their "Ivanhoe" patent welded steel sectional boiler, for which certain advantages are claimed as compared with cast-iron boilers. Researches have shown that as the result of repeated heating cast iron increases in thickness, and becomes a poorer conductor of heat. Consequently, in the case of a boiler made of this material, the cost of fuel for a given amount of work done must increase with the age of the boiler. The emission of heat per square foot per hour from the radiating surface of cast-iron pipe is put at 256 B.Th.U., and of wrought-iron pipe at 300 to 350 B.Th.U. But according to the results of a test of Messrs. Jenkins and Co.'s No. 3 boiler, using gas coke as the fuel, the maximum heat transmission was 9438 B.Th.U. per square foot per hour. As makers of cast-iron sectional boilers only claim a maximum of nearly 7000 B.Th.U. under favourable conditions, these figures show 30 per cent. greater efficiency for the steel boiler. It should be mentioned that the 9438 B.Th.U. were obtained with the damper full open. But when this was only half open, the figures were 7265 B.Th.U.; and when it was nearly closed they were 4257. The makers acknowledge that the first cost of their boiler is greater than that of a cast-iron one; but they claim that the difference is soon returned in the shape of savings on the fuel bill, and that economy is realized during the entire life of the boiler. Messrs. Jenkins state that a test of two of their boilers worked in comparison with two of cast iron (gas coke being used in both cases) showed a saving of 16 cwt. of fuel per week in favour of the steel boilers.

RATING OF GAS AND WATER UNDERTAKINGS,

WITH AN OUTLINE OF GENERAL PROCEDURE OUTSIDE THE METROPOLIS.

By Arthur Valon, Assoc.M.Inst.C.E.

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V.

Water Undertakings.*

Gross Receipts.

The gross receipts will be composed of water-rents—*i.e.*, amounts paid for supplies of water calculated either upon the gross estimated rental or rateable value of the properties supplied, depending upon the terms of the Special Act, and water supplied by meter and under contract. It is usual to calculate the water-rents by taking the amount that would be due if all the properties were occupied, and deducting therefrom those rents not received on account of empty houses. Any bad debts or allowances should be deducted from the gross receipts.

In addition, there may be meter-rents, service-laying account profit, rents, transfer fees, rental of mains, and interest on special mains. Rents of meters will be included. Where there is any profit under the head of service-laying account, it should be included; but if the amount varies considerably from year to year, it is proper to take an average. Rents will be usually in respect of properties separately rated, and must therefore be excluded from the valuation, so as to prevent the property being rated twice over. Transfer fees should be excluded. Rental of mains and interest on special mains are annual amounts paid by certain consumers, usually in consideration of mains being laid that would not otherwise be remunerative to the company, and should be included in the valuation.

Should there be any special items, they should be included, if they are such that the tenant could reasonably expect to obtain them as a result of his tenancy.

Expenditure.

The expenditure side of the revenue account is generally divided into three main heads—maintenance, management, and special expenditure.

Maintenance (*Pumping and Engine Charges, including Cost of Coal, Wages, &c.*).—This can be taken as appearing in the accounts, unless any part of the cost, such as the cost of coal, has risen or fallen materially since the close of the account year, or will probably do so in the immediate future. The same remarks applies to filtration, including cost of materials and labour.

Maintenance and Repair of Impounding and Service Reservoirs, Filtering Beds, Works, and Pipes, or for Obtaining and Storing of Water, including Cost of Materials and Labour. Maintenance and Repair of Mains, Pipes, Meters, Fittings, and Works connected with the Distribution of Water, including the Cost of Materials, Labour, and Renewals.—These two items are excluded from the working expenses so far as the maintenance is attributable to the hereditament, and therefore to be deducted under the head of landlord's statutables; but so far as the charges would need to be met by the tenant in the course of the business, it is properly included in his expenses as tenant's maintenance. The chief direction in which the tenant's maintenance is expended is in cleaning the filter-beds, engineers' and inspectors' travelling expenses, the repair and renewal of meters, the repair and maintenance of the sand washers (where these are not fixed to the ground, and hence chattels), repairs to tools, cost of repacking glands, or other incidental running repairs to the machinery, such as fixing valves, &c., cleaning-out boilers, and keeping the works in good order. Altogether, the tenant's maintenance will amount to a considerable sum; and one-third of the total maintenance is a figure that is frequently adopted.

Salaries of Engineers, Clerks, Inspectors, and Turncocks.—It will, as a rule, be sufficient to take these as appearing in the accounts.

Rents of Houses and Lands owing by the Company, including Wayleaves.—Where the property for which these rents are paid is separately assessed, the rents should be excluded from the expenditure and deducted from the gross estimated rental. As, however, these amounts are very small, it would be approximately correct to deduct the rateable value of properties separately assessed from the rateable value of the whole undertaking, instead of deducting the rents payable from the gross estimated rental.

Rates and Taxes.—As these are to be calculated on the new rateable value, it is usual to exclude them here and deduct them at the end of the valuation.

Insurance.—Workmen's compensation insurance must be included.

Management (*Directors' Allowances, Salaries of Secretary, Accountant, and Clerks*).—These are usually included as stated in the accounts; but a modification is sometimes made on the assumption that a portion is paid in respect of duties performed on behalf of the hypothetical landlord.

Collectors and Auditors, General Establishment Charges, Stationery, Printing, &c.—These will usually be included as given in the accounts.

Superannuation.—This will be treated in the same way as a similar item in the case of gas-works (*ante*, p. 588).

* For sample valuation, see Appendix D.

Law and Parliamentary (Opposition) Expenses.—This matter has been dealt with already (*ante*, p. 588).

Special Expenditure.—Any expenditure which will not come under the heads already given may be termed special expenditure; and in dealing with it, regard must be paid to the probability of a similar expense having to be met by a prospective tenant.

Deducting the total working expenses from the gross receipts, the balance is the net receipts, including rates. From this has to be deducted the tenant's share, in order to arrive at the gross estimated rental.

Tenant's Share.

The same principles as to the tenant's share will apply in the case of water-works as have already been explained in dealing with gas-works (*ante*, p. 669). But owing to the conditions and circumstances under which water undertakings are conducted, the amount of capital required by a tenant is small in proportion to the turnover of the business; and very frequently the tenant's share will be governed by considerations of the magnitude of the business and responsibility devolving on the tenant apart from the actual amount of capital which it is necessary for him to employ. In these circumstances, it is therefore not at all unusual for the tenant's share to be calculated by taking a percentage upon the gross receipts; the actual figure varying, according to the circumstances—a figure frequently taken being 10 per cent.

Tenant's Capital.

This will consist of the following items:

Working Expenses.—The exact period for which these are to be taken will depend on the dates at which the rates are collected. Water-rates are usually payable in advance; but it is frequently the practice to collect them in arrear, or partly in arrear and partly in advance—*i.e.*, about half-way through the period for which the rate is payable. The amount of capital required to meet the working expenses will be equal to the amount of the outgoings up to the date at which the water-rates collected are sufficient to meet the current expenses.

Rates and Taxes.—The amount required to meet this expense will also depend upon the dates at which the payments have to be made. The whole of the payment required within the period for which the working expenses are calculated must be allowed for.

Meters.—The present value of the meters in use and in store. The actual depreciation allowed from the net cost will vary with the condition and age of the meters.

Office Furniture and Tools and Implements.—The present value of the tools and implements here valued will be those attributable to the tenant; and an allocation must be made for this purpose of all the tools and implements—any used solely for repairs to the hereditament being excluded from the valuation.

Stores on Hand.—The value of the stores necessary for the tenant to have on hand for the conduct of the undertaking.

Maps and Plans.—The value of the maps and plans which the tenant requires. Those which would be required only by the landlord should not be included.

Cash at Bank.—Any balance necessary to be kept at the bank.

For general remarks with regard to the tenant's share, see *ante*, p. 669.

The amount of the tenant's share, deducted from the net receipts, including rates, will leave the gross estimated rental, *plus* rates. From this sum has to be taken the

Landlord's Statutables.

These will be composed of the repair and renewal of the hereditament. They are best arrived at by taking an average over some years of the maintenance and repair of reservoirs, filtering beds, works and pipes for obtaining and storing of water, including materials and labour, and the maintenance and repair of mains, pipes, meters, fittings, and works connected with the distribution of water, including materials, labour, and renewals. The amounts are calculated per million gallons of water pumped, and the resulting figure applied to the quantity of water pumped during the account year. A proportion of this is attributable to the tenant's maintenance. The amount varies to some extent; but, as already stated, a figure frequently adopted is one-third.

A large proportion of the works required by a water undertaking does not necessitate any repairs over long periods—indeed, the amount of repair is often small right up to the time that it becomes necessary to renew. The amount included under the head of repair and maintenance will not therefore, in all probability, include the real average annual expense for renewals. If a very large renewal has become necessary during the period over which an average has been taken, the total amount of maintenance may be more than the average; whereas, on the other hand, it may be that no renewals have been carried out. In order to meet this difficulty, the renewal of buildings, plant, and the large mains is provided for by calculating the annual payment into a sinking fund to meet the renewal when it becomes necessary. The period for which the sinking fund is calculated is usually about sixty years—the exact life depending on the relative values and lives of the separate portions of the plant; and the sum found in this way is added to the average of the maintenance already calculated. It must, however, be remembered that any renewals, for which provision is made in the sinking fund, must be excluded from the other maintenance, should such have taken place during the period over which the average is calculated.

The cost of renewal of reservoirs and filter-beds is, in some cases, not included in the sinking fund, because their length of useful life is so protracted that the annual amount required to pay into a sinking fund is negligible. In the case of small mains, the renewal of these goes forward fairly regularly, and may be taken to be included in the maintenance.

The total landlord's statutables, being deducted from the gross estimated rental, *plus* rates, will leave the rateable value of the whole undertaking, including the rates; and if the rates are deducted, the remainder will be the rateable value of the whole undertaking.

The rateable value is then distributed between the various parishes on the same principles as were explained on page 763.

APPENDIX D.

THE ..... WATER COMPANY.

VALUATION *of the Company's undertaking for Rating Purposes, based on the Accounts for the Year ending* .....

Gross Receipts.

By Sale of water		£103,150
,, Rental of meters		730
,, Profit on service laying		115
,, Interest on special mains		85
		£104,080
Less written off as losses, empty houses, and bad debts		3,780
Total gross receipts		£100,300

Tenant's Working Expenses.

Pumping and engine charges	£7,956	
Filtration	842	
Salaries of engineer, clerks, inspectors, and turncocks (Maintenance and repair of reservoirs, &c., and maintenance and repair of mains, &c., excluded. See tenant's maintenance below, and landlord's statutables.)	5,904	
Directors' allowances, auditors' fees, salaries of secretary, accountant, and clerks	2,962	
Superannuation of servants, collectors' salaries, stationery, printing, and general establishment charges	3,637	
Law charges (Rents, rates, and taxes excluded.)	320	
Tenant's maintenance, taken at one-third of amount allowed under landlord's statutables	2,019	
		23,650
Net receipts		£76,650

Tenant's Capital.

Consisting of:	
Working expenses	
Rates	
Meters (less depreciation)	
Office furniture	
Tools and implements	
Stores on hand	
Maps and plans	
Cash at bank	
Tenant's share, taken as an example at 10 per cent. of gross receipts of £100,300	10,030
Gross estimated rental, *plus* rates	£66,620

Statutable Deductions.

Maintenance and repair of impounding and service reservoirs, filtering beds, works and pipes, or for obtaining and storing of water, including materials and labour; Maintenance and repair of mains, pipes, fittings, meters, and works connected with the distribution of water, including materials and labour (five years' average)	£6,057	
Less tenant's portion, in this case taken at one-third	2,019	
	£4,038	
Add sinking fund for renewal, based on average life of 60 years (3 per cent. table)	712	
		4,750
Rateable value of whole undertaking, *plus* rates		£61,870
Deduct rates at average of (say) 6s. 8d. in £		15,467
Rateable value of whole undertaking		£46,403

Note.—Apportionment is arrived at in the same way as method shown in Appendix A (*ante*, p. 517), commencing at rateable value, *plus* rates.

Recent Wills.—The will with two codicils of the late Sir John Aird, Bart., whose death was recorded in the "JOURNAL" for the 10th of January, has been provisionally proved at £1,100,000. The testator bequeaths to each of his sons an immediate legacy of £50,000 and specific bequests of pictures and other works of art. Among the legacies are £1000 each to the four principal members of the staff, and £250 each to five others. The residuary estate is bequeathed in equal shares to his two sons. Mr. Samuel Allcock, a Director of the East Worcestershire Water Company, left £29,972. Mr. Francis Jackson Kent, of Hazelhurst, East Molesey, solicitor, a Director of the Hampton Court Gas Company, and Chairman of the Walton-on-Thames and Weybridge Gas Company, left estate of the gross value of £18,336, of which the net personalty has been sworn at £5569.

STEAM GENERATING BY GAS.

The Bone, Wilson, and M'Court Boiler-Heating Patent.

Among the patent specifications issued last week, was one in the names of Dr. W. A. Bone, Professor of Applied Chemistry at Leeds University, Mr. James W. Wilson, and Mr. Cyril D. M'Court, for "Improvements in and Relating to Steam Generation, Feed-Water Heating, and the Heating of Liquids Generally," which requires fuller treatment than can be accorded in our "Register of Patents" columns.

The patentees state that their invention is designed to utilize the heat resulting from gaseous combustion, and has reference to the class of apparatus in which the heated products of combustion pass through a tube or tubes, which traverse the vessel containing the liquid or vapour to be heated—such products of combustion being then discharged into the atmosphere. Their principal objects are to utilize for the purpose in view as large a proportion as possible of the available heat produced, and at the same time to transmit a large proportion of heat per unit area of heating surface. They propose to employ coal gas, coke-oven gas, producer gas, blast-furnace gas, natural gas, or other combustible gas or mixture of gases amenable to their method of procedure—all such gas or mixture of gases being designated by them as "combustible gas."

The mixture of combustible gas and air substantially in the proportions theoretically required for complete combustion or with air in slight excess is passed into a bed or beds of refractory granular material packed or charged in a tube or tubes traversing the body of liquid to be heated, and at a pressure sufficient to overcome the resistance to gaseous flow exercised by the granules, and at such a speed that back-ignition of the mixture is prevented. In order to prevent clogging of the granular beds, the gases should be freed from dust by washing or otherwise cleaning. In cases where gas of low heating power is water-washed when hot—for example, producer gas—the steam content must not be such as will interfere with its combustion in the granular bed.

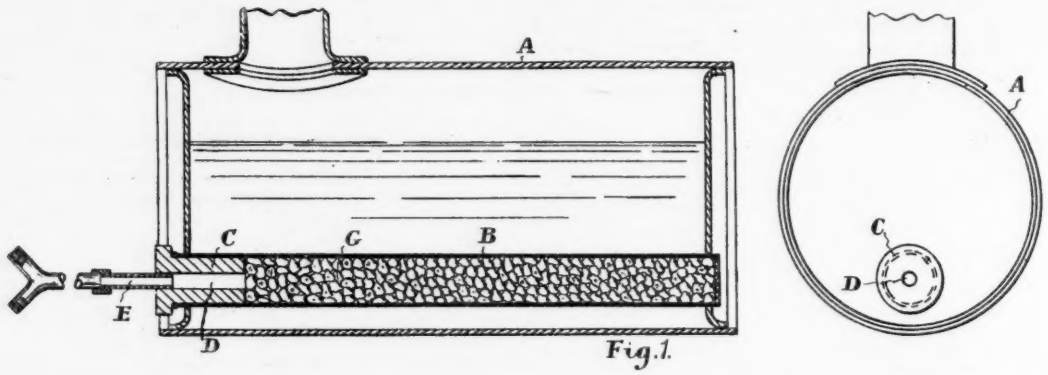


Fig. 1.

They first describe the invention as applied to a small steam generator comprising a cylindrical shell traversed by a single tube packed with granular material, shown in fig. 1. A is the boiler shell. B is the tube closed at one end by a fire-clay plug C, provided with an aperture D for the introduction of the gaseous mixture. The head of the plug is by preference enlarged, and projects somewhat from the tube B; and a tight joint may be secured by winding the plug with asbestos string plastered with white lead or the like prior to insertion in the tube, or a groove may be made around the plug for the reception of asbestos packing. The tube B is packed with fragments of refractory granular material G—for instance, fire-brick crushed to such a size as will pass a sieve of one mesh to the linear inch, and having the finer material, such as will pass a sieve of two meshes to the inch, taken out. The material is retained at the exit end of the tube by means of a stout gauze or the like D^1. At the inflow end, a layer of pieces of a larger size may be used, in order to prevent choking of the gas inflow tube.

The diameter of the aperture of the plug must not be so great as to allow the gaseous mixture to fire-back and burn therein; and it has been found that a diameter of $\frac{5}{8}$-inch is suitable for this object when admitting a mixture of coal gas and air at the rate of about 100 cubic feet of coal gas per hour with its necessary quantity of air.

The gaseous mixture is conveyed to the central aperture D by a pipe E; the joint being rendered air-tight. Air and combustible gas, both under pressure, are supplied to the pipe from a Y-piece; the two supplies being controlled by valves. Each pipe is preferably furnished with a non-return valve. The gas and air will mingle on meeting in the Y-piece, and will mix thoroughly in passing down the pipe E and aperture D, provided that the combined length of run is not too short. A foot is sufficient.

In general, the method of starting up the generator will be to first turn on either constituent of the gaseous mixture, apply a light to the exit end of the tube B, and then slowly turn on the other constituent until the resulting flame travels back through the bed of granules, and combustion proceeds near the entrance end of it—thus raising the granules in the zone of combustion to a state of incandescence. The gas and air supplies are best adjusted so that a slight excess of oxygen is found in the products, "to secure complete combustion of the combustible gas."

If the tube B is of too great diameter, the heat developed at the hottest point may not pass away with sufficient rapidity, with the result that the granular material may be softened. When using coal gas, it is found that, with an internal diameter of 3 inches, fire-clay packing may be employed without material softening; while with an internal diameter of 4 inches, granules of fire-clay situated in the hottest zone are liable to become softened. In this case, the core of granular material at the hottest region should consist of carborundum or other very highly-refractory material. Where, however, the combustible gas is of low calorific intensity—as, for example, blast-furnace gas—this precaution is not necessary. In order to distribute the flow of heat more evenly along the tube, it is desirable in some cases to line it with refractory material for a portion of its length near the hottest point to secure the desired distribution. Fig. 2 shows a tube having a sleeve of fire-clay inserted near the end at which the gaseous mixture enters. This sleeve may be made tapering, having the thickest portion of the wall near the hottest place. As the partial prevention of the radiant outflow of heat will cause the core of granular material to be more highly heated, carborundum or other equivalent material should be used at this point.

Fig. 2.

The most suitable length of tube B to employ will depend on the diameter thereof, on the calorific intensity of the gas employed, on the rate of consumption of the gas, and on the temperature at which it is desired that the products of combustion should leave the generator; and, in general, it will be found that the invention lends itself to the construction of boilers provided with tubes shorter than those usually employed. For example, the patentees have found that when burning coal gas or coke-oven gas at the rate of 100 cubic feet per hour per tube, the tubes may conveniently be 3 feet long and 3 inches internal diameter.

The gas and air under pressure are supplied by a blower or compressor so long as the pressure is such as will supply the tubes with gaseous mixture at such a speed as to prevent back-firing through the aperture D of the plug C. The pressure will vary under different conditions and with different gaseous mixtures, and should be kept as uniform as possible. With coal gas, the inventors have worked satisfactorily with a gaseous mixture at a pressure of from 10 to 30 inches water-gauge.

In order to give some idea of the high heat transfer obtainable by the invention, the following instance is given, which relates to a horizontal boiler-tube 3 feet long (fig. 1) and of 3 inches internal diameter, a fire-clay plug projecting 4 inches into one end thereof, and the remainder of the tube being packed with crushed fire-brick of such a size as will pass a sieve of one mesh to the linear inch, but will not pass a sieve of two meshes to the inch. It has been found that when burning in this packed tube a gaseous mixture of coal gas and air such that only a trace of oxygen was found in the products of combustion when the gas consumption was at the rate of 100 cubic feet per hour (the net calorific value of the coal gas being about 560 B.Th.U.), the products of combustion issue from the end of the tube at the following temperatures dependent on the temperature of the surrounding water:—

Temperature of Water.	Steam Pressure.	Temperature of Products.
100° C.	0 lb. per square inch	219° C.
148° C.	50 lbs. ,,	251° C.
170° C.	100 lbs. ,,	266° C.

They have further found that in the first-mentioned case, where the water was boiling at 100 C., about 90 per cent. of the total heat available from the gas was transmitted to the water.

In some cases, it has been found difficult to start, owing to the liability of the flame, in running back through the granular bed, to shoot through the aperture in the fire-clay plug. The device shown in fig. 3 greatly reduces the risk of such back-firing. B is the tube; C the fire-clay or like plug. F is a chamber formed by a casing F^1, to which may be added a casting H^1 forming another chamber H from which a pipe H^3, of narrow bore, leads to the

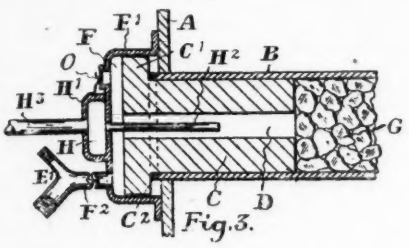


Fig. 3.

plug C and into aperture D therein. The chamber H is supplied with gas from a pipe H^3, and to the chamber F, by means of pipe F^3, is admitted the gaseous mixture of air alone. The chambers H and F should be as small as is practicable; and where a single tube is dealt with, the chamber H may be discarded—the pipe H^3 in such case being made continuous with H^3.

In starting firing, air alone is first admitted into the chamber F, and passes through the plug C and tube B. Combustible gas is then admitted to the chamber H, and passes thence to the tube B; a flame being applied to the exit end of the tube—the air or combustible gas as the case may be being increased until the flame strikes-back and combustion proceeds in the bed of granules After a few minutes, when the granules near the plug C become incandescent, the supply of combustible gas to the chamber H is shut off, and combustible gas is turned on to mix with the air which is being supplied to the chamber F.

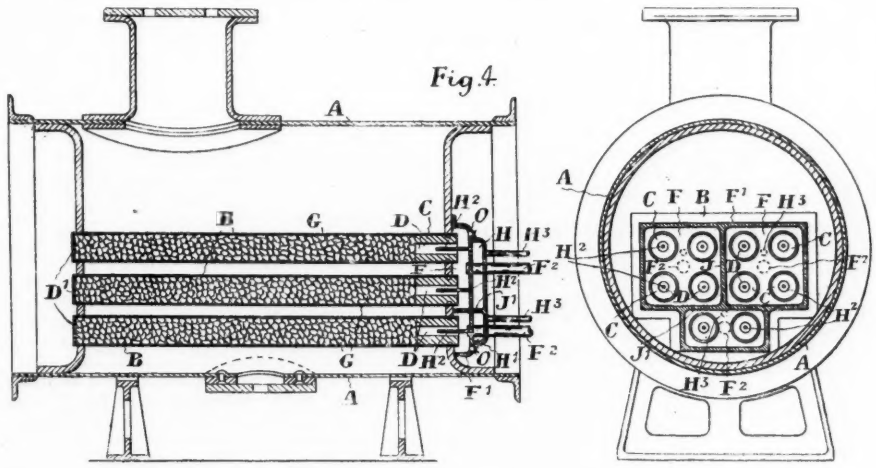
Where the gas employed is of low-heating power (say, blast-furnace gas), and the flame produced at the exit end of the tube or tubes cannot be made to strike-back through the granular bed, the generator may be first started up on coal gas, aërated petrol vapour, or other gas or vapour amenable to the method last described, and such gas or vapour is subsequently turned off and the poorer gas turned on to mix with the air supplied to the chamber F.

In fig. 4 (representing a sectional elevation and an end view of a boiler constructed in accordance with the invention), a ten-tube boiler is shown adapted to be fired by coal or coke-oven gas. The tubes B, at their entrance end, are enclosed by casings H and F arranged with their pipes as described with reference to fig. 3; and these casings, which are suitably attached to the boiler, are divided into three, by means of partitioned walls J J^1. Each casing has its own supply pipes. The tubes are in groups, two of four and one of two; and it is preferred that the gaseous-mixture pipes F^2 should be arranged in the centres of the groups to ensure a symmetrical feed.

Any water condensed from the products of combustion before the granular material has become heated throughout should be allowed to drain away.

Where a generator is arranged with its tubes in groups, certain advantages are said to accrue, in that one or more groups of tubes may be used when less steam or power is required. Thus, in the example given in fig. 4, two, four, six, eight, or ten tubes may be in use as required.

Fig. 4.



The chambers to which the gaseous mixture is admitted should be supplied with explosion doors O—hinged and retained against their seatings by means of springs so arranged that on any explosion taking place in the chamber the doors would open.

It has been found that the liability to back-fire through the fire-clay plug increases with the volume of gaseous mixture enclosed in the feeding-chamber; and hence it is desirable that the dimensions of the chamber should be kept as small as possible consistently with the proper distribution of the gaseous mixture to the tubes. This is particularly the case when dealing with high-grade gases having a relatively high rate of ignition (such as coal gas), and is less so in the case of low-grade gases (blast-furnace gas).

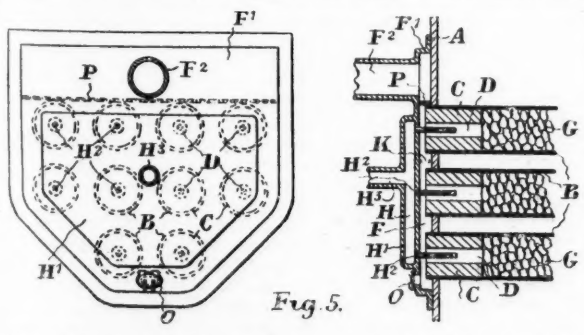


Fig. 5.

The patentees state that they have succeeded (using coal gas) in firing the ten tubes of the steam-generator shown in fig. 4 from a single feeding-chamber shown in fig. 5 by restricting the dimension K to $\frac{3}{4}$ inch; the boiler tubes projecting from $\frac{3}{8}$ inch to $\frac{1}{2}$ inch beyond the end plate of the boiler into the feeding-chamber. It is found that 20 inches water-gauge is a sufficient pressure at which to supply the air when admitting coal gas to mix with it after the granules have been initially heated by means of the starting device described. If these dimensions be exceeded, it will probably be found that a higher pressure will be required in order to prevent back-firing.

The mixture enters the chamber F immediately above a perforated partition P, through which the mixture streams to the tubes. In order to ensure a fairly evenly distributed supply, the total area of the perforations in the partition should be less than the area of the cross section of the supply pipe.

The invention, though described with reference to the heating of steam-boilers, is obviously applicable to feed-water heating and the heating of liquids generally; and all such applications are within the scope of the invention.

Manchester and District Junior Gas Association.—A very full programme has been arranged for the annual meeting of this Association, which will take place on the 1st prox. In the morning, the members will visit the works of West's Gas Improvement Company at Miles Platting, proceeding afterwards to the Bradford Road station of the Manchester Corporation's gas undertaking for an inspection of the huge holder now in course of construction there, and then going on to the Droylsden station, to see the Glover-West installation of vertical retorts at work. In the evening, the annual meeting will be held for the election of officers and the transaction of other business.

Applications of Electric Heating.—In the second of the course of Cantor Lectures on this subject which Professor J. A. Fleming, F.R.S., is delivering at the Royal Society of Arts, he discussed the methods of producing heat electrically. He said the production of pig iron had been carried out electrically in both Sweden and France; tests with a Keller furnace showing a consumption of 2000 to 2200 units per metric ton of pig. As the blast-furnace required about 16 cwt. of coke per ton of pig, of which 7 cwt. was used for reducing the ore, it was evident that electrical energy would have to be supplied at 1-20th of a penny per unit to compete with coke at 16s. per ton; so that it was unlikely that electrical methods would displace the blast-furnace either in the United States or in Great Britain.

THE COLLAPSE OF THE LARGE GASHOLDER AT HAMBURG.

Official Report on the Cause of the Disaster.

(*Continued from page* 762.)

In his report to the Lighting Committee of the Corporation, Professor Krohn proceeds to discuss the question of whether the scheme for the construction of the gasholder, as originally drawn up and checked, complied with the generally accepted rules of construction, or whether there was any culpable negligence involved in it. His report continues as follows.

"The safety of the members under compression against buckling has been calculated in the original scheme entirely by the use of the well-known Euler's formula. This formula is based on the assumption that the deformations of the material are proportional to the strains upon it. This assumption is valid only so long as the strains do not exceed a certain limit, known as the proportionality limit. If strains occur in excess of this limit, theory and experience teach that Euler's formula is no longer applicable. The breaking loads and factors of safety calculated according to this formula are really too high. For these cases there are empirical formulæ for determining the safety against buckling. These formulæ, having been deduced from investigations and according to experience, present in a sufficiently satisfactory manner the factor of safety of a rod or member under compression. Euler's formula has been generally applied in this incorrect manner in the static calculation made by the firm of F. A. Neuman, for determining the safety against buckling, as the strains postulated through the breaking load in the material exceed the proportionality limit, and in this case the appropriate empirical formula should have been used instead.

"The question of whether this improper use of the buckling formula constituted a breach of the generally accepted rules of construction must, however, be answered in the negative, as, unfortunately, in many technical circles and by many authorities—including, among others, the Prussian Office of Public Works—the unrestricted use of Euler's formula for determining the safety against buckling, is the rule. Actually in most existing iron buildings the members under compression have been calculated only with the aid of Euler's formula. That collapses of these structures have not more frequently occurred is to be ascribed to the circumstance that most authorities require a wider margin of safety than was introduced in the case in question when the scheme was drawn up; and in this way they partially at least compensate for the errors which are committed through the use of the incorrect formula. Thus, for instance, the Prussian Office of Works requires a safety against buckling five times that derived from Euler's formula, and takes as the length free to buckle the length of the system of the rod or member, whereas in the static calculation in the case in question only a four-fold safety against buckling has been adopted, and the length free to buckle has been taken at only 0·7 of the length of the system, having regard to the insertion or gripping of the ends of the rods or members. The Prussian Department of State, by its far-reaching requirements, actually secures that most of the compression members, calculated according to its prescriptions, though they have not the five-fold margin of safety shown by the calculation, have, even so, a margin of safety against buckling of two to two-and-a-half times, which is sufficient to avoid collapse in normal working conditions. There is still the question whether the reduction of the margin of safety allowed in the static calculation of the iron construction of the gasholder should be regarded as a breach of generally accepted rules of construction.

"As regards the reduction from five to four times the calculated degree of safety, it must undoubtedly be recognized that a four-fold margin of safety should have very amply sufficed for the structure in question. In itself, it was justifiable to regard a four-fold margin of safety as sufficient instead of the five-fold margin which the Department of State specifies for iron bridges, having regard to the fact that in this structure the loads to be withstood were mainly at rest and acting without shocks. If the four-fold margin of safety had only, in fact, existed, the collapse would not have occurred. That the safety was actually considerably lower, notwithstanding exact calculation, depended on an inapplicable formula having been used; and the engineer who drew up the scheme was led to adopt it owing to the prescriptions of the Office of Public Works, which requires the calculation of safety against buckling to be made unrestrictedly accordingly to Euler's formula. Moreover, it may be pointed out that the Prussian Department of State is itself content with a four-fold margin of safety calculated according to Euler's formula for high structures, taking the case of the most unfavourable strain.

"There was therefore no doubt that the static calculation in question could not be attacked on this account; but it was less clear whether it was permissible to introduce as the length of the rod free to buckle the value 0·7 *l*, where *l* represents the total length of the system. When the ends of a rod are firmly inserted and gripped, so that turning about these points cannot occur according to theoretical determinations based on the law of proportionality, the value 0·5 *l* is introduced into the calculation as the free buckling length. As the breaking load increases in inverse proportion to the square of this length, it rises to four times the value which it has when the ends of the rods are free to turn. As a fact, however, in riveted structures, such as that under consideration, the ends of the rods are not free to turn round. By the riveting of the joints, they are, to a certain extent, gripped, though, in consequence of the elastic yielding of the points of junction of the structure, there can be no question of a completely rigid gripping. The contracting firm had considered it permissible to introduce as the length free to buckle a middle value—*viz.*, 0·7 *l*. On this assumption, the breaking load, calculated according to Euler's formula, rises to double what its value would be with the ends free to turn. As to whether this assumption is justifiable, different views can doubtless be held. He (Professor Krohn) personally held the view that as the value of the gripping varied very much according to the method of construction and, in certain circumstances, would be very small, it would be better for safety's sake generally to take no account of the favourable effect of the gripping, though by this course in some circumstances too great a margin of safety would be obtained. It may be observed, further, that if the calculation is made with the empirical formulæ applicable, instead of with Euler's formula, the question whether *l* or 0·7 *l* is introduced in it is for the most part of no great importance. The margin of safety does not sink to half through taking the smaller value for the length; but in the customary proportions for the rods, it has about 15 per cent. of the value which would be found if the whole length of the system were taken as the buckling length. In comparison with the coefficient of safety usually adopted, the question whether the value *l* or 0·7 *l* is introduced in the calculations for the buckling length no longer plays an important part.

"Apart from his (Professor Krohn's) personal view, however, he points out that the adoption of a reduced buckling length has its exponents. In the first place, a well-known and esteemed engineer—namely, Dr. von Emperger, of Vienna—has for years past, both by word and in writing, advocated the adoption in calculation of the value 0·7 *l* as the buckling length of rods under compression in riveted structures, both when empirical buckling formulæ are used as well as when Euler's formula is used within the range for which it is applicable. [References to expositions of Dr. von Emperger's attitude in Austrian and German engineering journals are given.] Some German authorities also favour a reduction of the length. Thus, the Royal Bavarian State Railway, in its specifications for iron bridges and elevated structures, prescribes that the cross section of rods under compression should be calculated according to an empirical formula, and that in regard to the side rods or members of lattice girders the buckling length should be taken for the calculation at four-fifths of the length of the system, when the points of junction are to be regarded as being rigidly united; while for compression ties the length of the system is to be adopted as the buckling length. The Royal State Railway of Saxony also introduces the length of the system of members under compression as the buckling length. But a short time ago, in the specification for the railway station at Leipzig, they prescribed that, in calculating the side struts of built-up girders, three-quarters of the geometrical length should be taken with the unrestricted use of Euler's buckling formula.

"Hence it cannot be taken for granted that it is a generally accepted rule of construction to introduce when calculating the members under compression the length of the system as the buckling length; and an assumption such as has been made in Neuman's static calculation cannot well be regarded as an infringement of such a rule. He (Professor Krohn) would emphasize that this assumption respecting the buckling length of members under compression in the static calculation would not have been of great influence on the result of the calculation if the empirical formula of Tetmajer had been employed instead of the unsuitable Euler's formula. By the use of the former, it is open to question whether the adoption of a reduction of the buckling length to 0·7 of the length of the system would not be justified, as the small increase of the buckling load which is afforded by the use of the empirical formula of Tetmajer if the reduced buckling length is introduced, follows probably in consequence of the insertion and consequent gripping which always exists. The cause of the false calculation is to be sought in the use of an unsuitable formula rather than in the introduction of a reduced buckling length.

"The result of Neuman's calculations was further influenced unfavourably by no regard being paid to the unequal distribution of the compressive force on the two separate rods, which occurs with built-up rods. It was only in recent years that attention had been directed to this matter, and only a short time ago that empirical formulæ had been established which allowed of account being taken of this unequal distribution of the load. No German authorities had so far made any prescription on this point in their specifications. Hence, neglect to take account thereof could not certainly be held to constitute a breach of the generally recognized rules of construction."

The following are Professor Krohn's conclusions: "The cause of the collapse was to be found in the inadequate dimensions of the rods of the framework which were subject to pressure. These rods were of insufficient size because their factor of safety was all through calculated by the aid of Euler's formula for buckling, which theory and experience demonstrate has only restricted

applicability. This method of calculation, however, could not be regarded as an offence against generally accepted rules of construction, because many German authorities—*e.g.*, the Prussian Office of Public Works—sanctioned in their regulations this fundamentally inappropriate method of calculation."

A Report by Herr Schimming.

Herr Schimming, the Manager of the Berlin Corporation Gas-Works, presented his report on the collapse early in December last. He expressed himself as follows.

"The collapse of the supporting structure of the inner roof of the annular tank could have resulted from strains having been put upon the structure in excess of those on which the constructor based his calculation. The effective load—*i.e.*, the load exclusive of the weight of the roof structure—which the inner roof of the holder must carry in course of normal working, was determined thus: On top of the roof of the tank there was a layer of water to the level of the overflow sluice, 400 m.m. (= 15·7 inches) in depth, corresponding to a weight of 400 kilos. per square metre (= 81·9 lbs. per square foot) of area of the roof, when the pressure within the holder bell was equal to that of the outer air. With the holder in action and the lifts cupped, there was no greater load, notwithstanding the pressure of the gas, because the pressure displaced the equivalent amount of water which ran off through the overflow pipe. During the cupping of a lift, however (especially when the holder was filling up quickly), the considerable quantity of water driven out of the interior of the bell by the gas pressure could not run off through the overflow pipe as quickly as it was displaced by the gas pressure. As a consequence, there might be at each cupping of the bell an additional load of more than 40 m.m. (= 1·6 inches) of water, corresponding to 40 kilos. per square metre (= 8 lbs. per square foot) of roof area. All was not done, however, when this supplementary load was added to the normal load. There were other cases which might occur (even with properly supervised working) which introduced still more unfavourable loads—such as the blockage of the overflow pipe by ice, icicles, or other objects. The tank would then fill up with water to the top edge of its rim—viz., about 120 m.m. (= 4·7 inches) higher than normal; and then the effective load on the roof would rise to 520 kilos. per square metre (= 106·5 lbs. per square foot). This represented the maximum load or most unfavourable pressure on which to base the calculation in normal working conditions. It was not sufficient to take, as did the contracting firms, an effective load of only 400 kilos. per square metre (= 81·9 lbs. per square foot) as the basis for the calculation. The necessary margin of safety against rupture and against crushing of the rods or members ought to have been provided for the former load—the tensile strain should not have exceeded 1000 kilos. per square metre (= 204·8 lbs. per square foot), and against crushing at least a four-fold margin of safety should have, by careful calculation, been present throughout. Nevertheless, such an installation could be destroyed if loads occurred which considerably exceeded this amount.

"Such a load—far in excess of that measured by twice 520 = 1040 m.m. (= 40·9 inches) of water—could occur if an explosive mixture of gas and air was in the holder, instead of coal gas, and the mixture was ignited. Such a mixture might be produced through gross irregularities in working; and its ignition, though likewise very difficult, might, by a concatenation of a number of unfavourable circumstances, be possible. The possibility of the presence of an explosive mixture must be taken into consideration specially, because phenomena were observed which might point to an explosion inside the bell. Four witnesses, who were on the sinking bell, said that the bell rose and fell twice. Though these witnesses might, in the circumstances, have conceivably gained an erroneous impression as to the exact course of the movement of the bell, others who were on the galleries and near to the carbonizing chambers had testified that the bell actually was projected upwards. A sudden heaving up of the bell of a gasholder of this kind signified as a rule that an explosion has occurred inside. The length of flames produced in the course of the disaster left it to be inferred that the gas contained in the holder was of good quality and inexplosive. The time of combustion of the gas had been stated by the Fire Brigade to have been at least four minutes. The combustion when an explosive mixture took fire was quite different and quite sudden. In accordance with these observations, it had been clearly established that the presence of an explosive mixture in the bell of the holder on the day of the collapse was absolutely out of the question. The gas in the holder on Nov. 25, between 8 and 9 o'clock was found to contain so little air that there was no noticeable effect on the illuminating power of the flame. Such coal gas would be quite inexplosive, and far removed from the explosive limit. Further reports showed that up to the time of the accident the holder had been frequently refilled with fresh gas of unimpeachable quality, and the town had been supplied with gas from the holder. Consequently, there had been a frequent change of the gas in the holder, and the gas distributed from it was always of such a quality that it must have been quite inexplosive. It was therefore clearly out of the question that an overloading of the iron structure could have been produced through an explosion in the interior of the bell of the holder.

"Another condition which might cause overloading of the roof of the tank would be the jamming of the bell or one of the lifts in the guides of the framing. In this manner very high-pressures might result. If, for instance, the bell jammed in its lowest position, the pressure might rise, if the other apparatus on the works admitted of it, until the gas ultimately was forced beneath the lower edge of the jammed bell. Sudden loads or shocks on the roof of the tank also might be caused through the parts of the bell jamming—as, for instance, by the bell, some time after jamming, getting free again before the supporting structure of the roof of the tank had given way. In this case, there would be a greater pressure beneath the roof than was necessary for the support of the bell, and the bell would be projected higher than corresponded to the excess of pressure. It would then recoil, and in certain circumstances could produce a considerable rise of pressure. A similar event would ensue if, owing to the guiding of the bell being faulty, the lifts did not cup properly, or if objects which could not be compressed caused at first gripping of the lift askew in the cup and after a little time proper gripping took place with a shock. Whether overloading of this kind did occur had to be thoroughly investigated, because re-examination of the two cups which were in action on the day of the collapse of the holder revealed a number of extraneous objects which had adventitiously gained access to the cups. Opposite two places in the cup of the first lift deformation of the vertical struts of the next lift had been found. At one place, moreover, on the vertical struts of the second lift, the paint had been scraped off through the rubbing of a bulge of the cup. The objects found in the cups, however, were, with three exceptions, not such as would greatly affect the working of the cups. The exceptions were a tapping hammer, the wooden handle of which was cracked, a shovel which was crushed, and a lump of concrete which had not been subjected to pressure. But he (Herr Schimming) could testify from his practical experience that such small objects were of no consequence so far as the regular working of the cups was concerned. The character and location of one of the deformations of the cup of the first lift signified that it was produced during the sudden descent of the bell, which first descended together with the first lift, and was then impelled upwards. In the upward movement, the edge rubbed against the vertical struts, and, catching, was bent and pressed out upwards. The second deformation appeared, however, to point to the interposition of a foreign body. There was evidence that these injuries were not existent prior to the holder being taken into use. The distortion, however, could not have had any serious effect on the travel of the bell. Though such an explanation of the deformations might appear to be supported by the phenomena observed, it could not be established with certainty from these circumstances that a jamming of the bell had not taken place.

"It was, therefore, of special importance to establish whether there were quite satisfactory indications from which it might be deduced whether or not there had been an unreasonable loading of the roof of the tank—ruling out an explosion in the bell. The water seals in different places afforded such indications—viz., the seal in the raised cups of the holder, the gauges in the governor and purifier houses, and the seals of the purifiers. The seals on the purifying plant, however, were only significant when the holder was being filled. If the pressure in the holder, which determined the pressure on the roof of the tank, were either gradually or suddenly raised, in ways already referred to, above that of the depth of the seals, the water would be expelled from the latter. If the rise of pressure were gradual, the expulsion of water would occur exactly at the pressure thrown by it; but if there were a sudden rise or shock, the expulsion would take place at a far lower gas-pressure than corresponded to the full height of the seal, owing to the inertia of the water suddenly set in motion.

"The seals of the purifiers would blow at a pressure of 650 mm. (25·7 inches); and they had not blown from the time the new gasholder was brought into use up to the time of its collapse. The latter occurred while the holder was filling, and the pressure during filling could never have caused a greater load on the roof of the tank than 650 mm., *plus* the difference of pressure due to the relative heights of the purifiers and the tank-roof—viz., about 12 mm., which would give a total pressure of about 26 inches. But it had been shown earlier that the water would overflow the edge of the tank at a pressure of 520 mm. (20·6 inches). With a suddenly imposed load, however, the inertia of the water would come into question, and a higher pressure than 20·6 inches could occur suddenly without causing the water to overflow. The impulse of pressure or shock might be so sudden that the water would scarcely be set in motion at the moment, so that the load of water would not be lessened with an increase in the pressure of the gas as it would be in normal working. As the holder had two cups above the tank level, the seal in the cups also came into question. The highest pressure possible in them was 765 mm. (33 inches), which corresponded with a load on the tank roof of 765 kilos. per square metre (156·7 lbs. per square foot). As the holder had been regularly at work, and there had been no interruption such as blowing of the seals in the cups would have caused, it was certain that, up to the time of the catastrophe, this pressure had not been exceeded. This pressure, moreover, was far within the limit of that which the supporting structure of the tank should have withstood. It was not, however, definitely established what occurred with the cups at the moment of the accident. There was no evidence that they had blown; and even if there had been, it would not have been of much importance, because the movement of the water and the fluctuations of pressure which must have taken place during the sudden fall of the bell might well have resulted in the water overflowing the cups. It was, therefore, only possible to consider the seal of the cups in relation

to events up to the time of the catastrophe, and not in relation to what occurred in the course of the collapse. The gauge in the governor-house therefore remained the most valuable indication of the pressure. This gauge was in communication with the main connection to the holder, both when gas was passing in or out of the latter and when it was at rest. It had been established that this gauge was behaving properly, and that when the accident began there had been no exceptional changes of pressure, and that the coming into action of the second cup had been indicated by the usual rise of pressure. It had been proved incontestably that from Nov. 25 to the time of the catastrophe, the water in the gauge on the outlet main of the holder had neither been expelled nor replenished at all. This gauge would blow at a steady pressure of 423 mm. (16·7 inches). As it formed a very important link in the chain of evidence, an exact reproduction of this gauge was made and tested, to find at what pressure it would blow if the pressure came on with a sudden shock. The tests showed that, owing to the inertia of the water, the gauge began to eject water at a pressure, applied as a shock, of 265 mm. (10·5 inches). Hence it followed that at no time from Nov. 25 to Dec. 7, 1909, had there been a higher steady pressure than $423 + 12 = 435$ mm., or kilos. per square metre (89 lbs. per square foot) or a higher pressure due to shock than $265 + 12 + 290 = 567$ mm., or kilos. per square metre (116 lbs. per square foot). Therefore the effective load which could have come upon the roof of the tank from above could never have exceeded 116 lbs. per square foot."

Herr Schimming next deals exhaustively with the possibility of the collapse of the tank roof having been brought about through pressure from below, such as might have been caused by a local gas explosion in the underlying chamber, owing to gas having escaped through leaks in the roof, or in the connections, or from the canteen. He concludes that it was in the highest degree improbable that an explosive mixture could have been introduced beneath the tank from escapes of gas in the canteen.

"It could be positively established that no explosion took place beneath the tank. When combustion occurred so rapidly as to constitute an explosion, the sudden expansion of the products of combustion caused a concussion in the air, with a noise which certainly would be heard even if the explosion occurred in the open. But in a building the noise became a violent report. All witnesses were agreed, however, that there was nothing in the nature of a report, but only rushing and roaring such as would necessarily ensue from a quantity of gas issuing with the force of a hurricane. Not a single witness had heard a report, or any noise indicative of an explosion beneath the gasholder. On the other hand, a carpenter had witnessed the regular and non-explosive combustion of the gas at the outset. He had seen the end prop of the girder No. 26 lean towards the middle, and fall down together with the girders on either side; and while this was occurring, he had seen directly beneath the bottom of the tank a flame, which rapidly spread in all directions. His observations were consistent with the middle prop having first been crushed in, thereby causing the ends of the girder to tip upwards. The flat roof must then have broken away at its junction with the upright inlet and outlet connections, and in falling rubbed against them with great force. That the connections had been thus scraped was evident from subsequent photographs, and there was little doubt that sparks so caused had ignited the gas. However this may have been, the carpenter's observations showed that it was out of the question that the collapse could have been caused by an explosion beneath the tank."

Herr Schimming at this point in his report states that, for the reasons indicated in the foregoing summary of his remarks, an improper loading of, or strain upon, the roof of the tank could not have resulted from either an explosion within the bell or a sudden or gradual rise of pressure above the roof, or an explosion underneath it. Another possible cause of overstraining of the substructure of the tank roof might have been, he goes on to say, the sinking of the central column, or other portion of the base, through the foundation being bad. It was, therefore, necessary to investigate the foundations.

"Inspection showed no cracks in the concrete of the annular tank due to settlement. The only cracks were scratches caused by the scraping of the ends of the falling radial girders. Hence there had either been no settlement at all of the foundations of the annular tank, or it had been almost mathematically uniform in extent everywhere. Though in a structure averaging about 230 feet in diameter the latter occurrence was practically out of the question, it was best to assume that it might have occurred. In that case, if the central column had remained fixed, the water would have run from the centre towards the outside and taken the load off the central props which gave way. Therefore it might be regarded as certain that the behaviour of the foundation of the masonry ring had no unfavourable effect on the iron structure. It remained to investigate the behaviour of the central column. The drawings and calculations, on examination, showed that the dimensions were appropriate, while the particulars of the ramming showed that the work had been properly carried out. There was, therefore, no reason to suspect sinking of the foundation of the central column. Inspection after the accident revealed no cracks due to settlement. Moreover, levels taken before the erection of the ironwork and after its collapse showed that the central column had not altered in height. Any strain of the girder substructure, owing to permanent settlement of the column, was therefore out of the question. Any elastic settlement due to the load, or elastic displacement of the subsoil, could only result in the load on the central column being reduced relatively to that on the foundation of the ring. Moreover, such deformations would in any case have been too small to affect properly executed ironwork. The behaviour of the foundation could not, therefore, have caused overloading of the iron structure, and the only conclusion not excluded by the considerations already dealt with, was that the iron structure by which the roof of the tank was carried was inadequate for the requirements necessarily made of it. The insufficiency of the iron structure could only have been due to three causes—viz., either the material was bad, or the work was unsatisfactory, or the calculation was incorrect."

Herr Schimming gives reasons for concluding that the material was good and the work on the whole satisfactory; and he then proceeds to discuss at length the calculations by which the dimensions adopted for the ironwork were arrived at. This portion of his report is held over until next week.

(*To be continued.*)

FELD'S IMPROVED CENTRIFUGAL GAS-WASHER.

A patent has been taken out for France by Herr Walther Feld for an improved centrifugal gas-washer. The specification has lately been published, and from it the following particulars of the invention have been translated.

One of the appliances hitherto employed, an example of which is shown in vertical section in fig. 1, consists of a certain number of funnel-pipes or concentric cones, the upper ends of which rise one above the other from the outer to the inner ones, revolving upon a vertical shaft. The lower ends dip into the washing liquid, which is raised by the rotary motion to the upper edge, where it is sprayed and projected tangentially and in a more or less horizontal direction. The gases or vapours to be dealt with pass through the space between the walls of the washer and the upper periphery of the pipes; the liquid being sprayed through the space. Although this arrangement is very effective, it has several disadvantages. The inner cones are necessarily smaller in diameter than the outer ones; the result being that when the washer rotates, the lifting power exerted by the outer cones is considerably greater than that of the inner ones. The suction action consequently gradually decreases. This causes each cone to lift a different quantity of liquid; and their irregular action gives rise to other inconveniences.

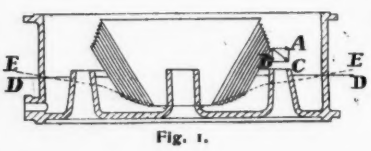


Fig. 1.

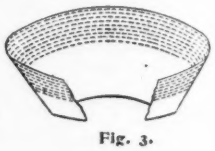


Fig. 3.

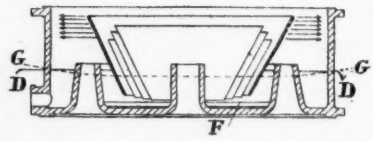


Fig. 2.

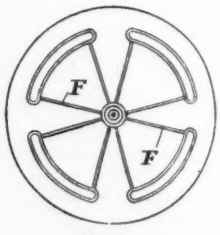


Fig. 4.

Owing to the relatively large quantity of water raised by the outermost cone, it is filled with a deep layer of liquid which is in direct contact with the surface. When this liquid reaches the upper periphery, its velocity is about the same as that of the cone itself. Its speed is sufficient to project the water in a horizontal direction, as shown by the arrow A in fig. 1. The upper layers which are not in direct contact with the rotating cone, move with considerably less speed than the cone itself; and this speed is inadequate to project the liquid horizontally. The upper layers of water, on reaching the circumference of the cone, have consequently a tendency to fall in the direction shown by the arrow B. The effect of the forces exerted upon the liquid is that it is thrown in the direction of the arrow C. This inconvenience, however, gradually decreases from the outer to the inner cones. As regards the latter, there is another inconvenience. As their diameter is considerably less than that of the outer cones, much less liquid is raised, and the circumferential velocity is not nearly so great as in the outer cones. Only a small amount of liquid, therefore, is sprayed by the inner cones in comparison with the outer ones. The effect is that the spraying power of the entire set of cones is very irregular.

In the present invention, arrangements are made with a view to remedying these inconveniences, so that the water raised by the entire group of cones will be distributed as regularly as possible in the space through which the gases pass, and the various layers of the sprayed liquid will have approximately the same velocity. The required effect is easily obtained by prolonging the outer cone upwards to the extent necessary to make it reach or exceed the height of the inner cone. This extension is provided with the

requisite perforations. Fig. 2 is a vertical section through a washer of the type described in the first invention; and fig. 3 is a view of a separate cone.

This device has proved so effective that a single cone, perforated in the part emerging from the liquid, is sufficient. When it is desired to increase the duty, a much smaller number of inner cones can be employed, and better spraying be effected with the arrangement shown in fig. 2 than with that shown in fig. 1. As represented in the former diagram, the inner cones, when there are more than one, merely supply water to the higher part of the outer cone. Perforations may likewise be made in some or all of the inner cones, at their higher part. Though any kind of perforation can be adopted, it has been found that rectangular openings, as shown in fig. 3, give the best results—the spraying being more uniform.

When in motion, the concentric cones have another disadvantage which has a further unfavourable influence on the spraying action. By the rotation of the series of cones, the liquid into which they dip is set in motion, and pressed against the sides of the vessel containing it. The line D in fig. 1 marks the level of the liquid when the cones are at rest. Immediately they begin to move, the water attains the position indicated by the line E. The level of the liquid consequently falls towards the centre of the vessel, so that the supply of water to the inner cones is decreased, and its action impaired. Numerous experiments have demonstrated that this defect can be avoided by baffles or devices to check completely or partially the motion of the water into which the cones dip. This is easy to realize by furnishing the sides of the vessel with ribs or vertical and radial compartments which totally or partially prevent the rotation of the water. Other experiments have demonstrated that the movement of the water may be stopped by fixing on the bottom of the vessel one or more ribs passing under the inner cone, as at F in figs. 2 and 4. The effect produced by checking the water is shown by the line G in fig. 2, which represents the water-level during the rotation of the set of cones. The result is that, owing to these ribs or baffles, the water in the centre of the rotating cones remains at much the same level as with the set of motionless cones; the effect of the inner cones being thereby considerably increased.

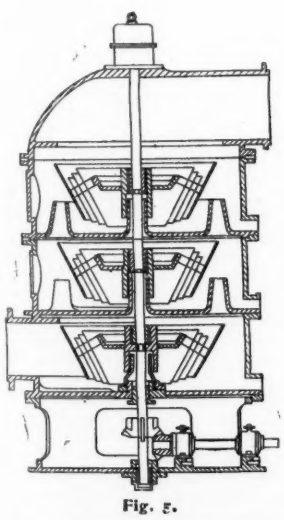


Fig. 5.

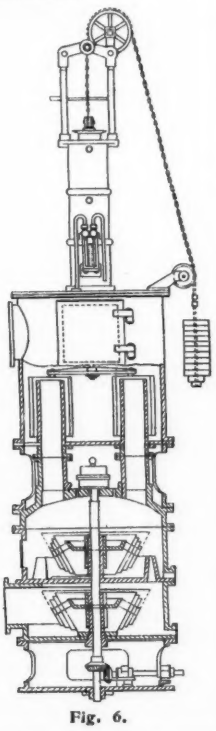


Fig. 6.

Fig. 5 shows a washer with superposed compartments, each chamber being fitted with the arrangement above described. It can be employed for any purpose whatever when gases or vapours are to be treated with liquids. Where it is used to extract tar or oils from gas resulting from the distillation of coal, or to remove very fine particles of liquid, forming a kind of fog, in gases or vapours, it is advantageous to adapt to it a Pelouze and Audouin condenser, as shown in fig. 6, to take out the final traces of tar.

Mr. Balfour Browne on Water Supply.—At the Royal Institution on Friday, Mr. J. H. Balfour Browne, K.C., gave a lecture on water supply. In the course of it, he said the lesson to be learnt from such floods as occurred in South Lincolnshire just before Christmas was that we should come to some comprehensive conclusion as to a scheme by which to prevent floods and tide us over periods of dry weather. What was wanted was a comprehensive knowledge both of the overground and the underground reserve sources of water; and until this was prepared, any legislation with regard to water supply must be merely temporary, unscientific, and futile.

COSTE'S NEW GAS CALORIMETER.

In the "JOURNAL" for the 28th ult. (p. 603), a short account was given, with a photograph, of a new still-water gas-calorimeter which has recently been designed by Mr. J. H. Coste, and which was described in a paper that he and Mr. B. R. James brought before the London Section of the Society of Chemical Industry. This was all that, under the rules of the Society, we were able to publish at the time; but now that the full text of the paper has appeared in the Society's own journal, we reproduce it, together with the illustrations as there given.

Still-water calorimeters, in addition to possessing the advantages of portability and simplicity, can be used with very small quantities of gas; and if the construction is suitable, a rational correction can be made for errors due to radiation. The calorimeter described has been designed by one of us (J. H. Coste) with a view to obtaining an instrument of high efficiency in which errors incident to instruments of this class designed for technical purposes should be very greatly reduced in amount, and the corrections simplified as far as possible. The instrument consists of: (1) The gasholder and measure; and (2) the calorimeter and burner. These are shown in section in figs. 1 and 2.

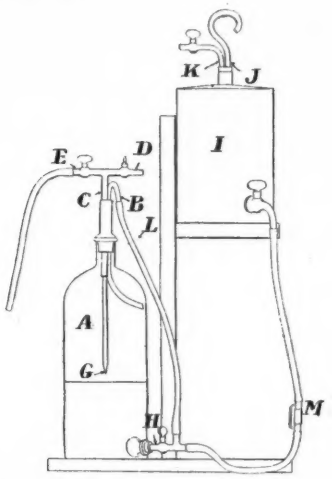


Fig. 1.

The gasholder (fig. 1) is constructed on Mariotte's principle. It consists of a glass bottle A of about 2 litres capacity with a tubulure at the bottom. The neck at the top of the bottle is fitted with a rubber stopper through which pass a water-delivery tube B and a gas-delivery tube C, which is preferably branched in T form with a stopcock on each of the limbs D and E. D communicates with the gas supply to be tested, and E with the calorimeter. A metal rod G, pointed at the end, passes through the stopper to such a depth that the capacity of the portion of the bottle from the level of the point G up to the bottom of C is exactly $\frac{1}{10}$ of a cubic foot. This is the amount of gas which is burnt during an experiment. The water-tube B and the tube at the side-neck H are both connected to a tubulure at the bottom of the water reservoir I. Clips or stopcocks are arranged so that either H or B can be cut off from communication with I. A tube J passes nearly to the bottom of I; and a side tube K with a stopcock also passes through the cork, which closes the neck of I. The volume of this latter vessel is rather greater than that of A. It is filled with water, and placed on a suitable stand, and the communication with H opened; that with B being closed after enough water has flowed through B to remove all air from it. If E is opened, water flows in, displacing the air, until it reaches the level of C, or if left to itself to the level of J in the upper part of C. The bottle A can now be filled with gas by closing E and opening D, and lowering I to below the level of A; the tap K being opened, if it is not already open. When A is nearly full, D, H, and K are closed, and I is placed on the shelf. When the experiment is actually to be started, L is opened, E is also opened, I is raised momentarily, if necessary, to start the flow of water, and gas now flows from E through the burner at an absolutely constant rate. It should be lighted at once. A line which gives warning when the operator should be ready to transfer the burner under the calorimeter, passes round A below the point G. In order that the contact of G with the surface of the water may be more easily observed, and any loss of time in transference may be minimized, a simple bye-pass is inserted in the rubber tube connecting B with the water reservoir I. This device consists of two pieces of brass tube connected by a piece of rubber tubing, and also by a very narrow brass tube. When the rubber tube is pinched by the finger and thumb, water can only pass through the small metal tube. This should be done when the line is reached, and the burner be swung under the calorimeter just as contact is made by the water with G; the finger and thumb being then removed.

The calorimeter, fig. 2 (showing left half section and right half view of interior), is constructed as far as possible on the sound

principles adopted by Berthelot and his followers for minimizing uncomputable errors and rendering possible the correction of those which cannot be avoided.

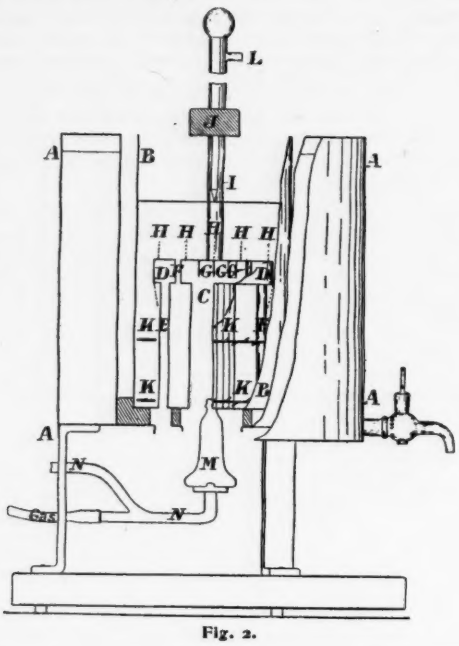


Fig. 2.

An annular copper vessel (A) holding 7 to 8 litres surrounds the calorimeter, from which it is separated by an air-space of about ¾ inch. This vessel is polished on the outside and enamelled white inside. It contains water, which should, if possible, be of the same temperature as that in the calorimeter. This may be effected either by filling both at the same time or by keeping a supply of water for the calorimeter near the instrument. The conditions of the laboratory will determine this matter for individual workers. The calorimeter and its surroundings are thus prevented from differing seriously from each other in temperature —a very important point—and the effect of the less immediate surroundings is greatly reduced; while a small but regular radiation is allowed during the progress of an experiment. This device is altogether preferable to the older method of "lagging" with non-conducting materials.

The calorimeter vessel (B) is constructed of copper. It is cylindrical in form; its length being about 1·7 times its diameter. The exterior is nickel-plated and highly polished. It is supported within its jacket by small wooden blocks. A central cylindrical chimney C, of stout corrugated copper tubing, rises from the bottom, and serves as a combustion chamber. It opens into a flat oval copper box D, from the ends of which depend two very much flattened corrugated copper tubes E. These tubes and the central chimney are open at the bottom of the calorimeter vessel, and with the box form the path through the calorimeter of the gases resulting from combustion. A wooden ring protects the combustion chamber from inleak of the products of combustion, which finally escape through holes in the bottom of the water-vessel. Suitable deflectors separate the products from the air passing in to support combustion.

The central chimney passes into the oval cooling chamber, which is pierced on either side by a long narrow water-channel F, separating the side or exit chimneys from the above-mentioned central one. Strips of copper G, depending from the top of the cooling-chamber, divide the ascending current of air, the branches of which are forced against the metal sides of the chamber and round the water-channels to the exit-tubes. On the top (projecting into the water in the calorimeter) are ribs of perforated copper H, which promote a rapid transfer of heat from this place, where the heated gases first strike the metal, to the cooling water.

The calorimeter vessel holds about 2·1 litres of water, the exact amount of which is fixed for an experiment by the coincidence of its surface with a nickel silver point I, depending from a teak bridge J, which rides on the edges of the vessel and, incidentally, carries on one side the thermometer and on the other the bearing for the stirrer. It also fixes the vessel in its place and forms a handle for the apparatus. The pointer is centred in position, and is, therefore, independent of any levelling arrangement.

A double horse-shoe stirrer K, as large as will pass under the oval box, is used, the two portions of which are separated by a vertical interval of about 2 inches, and provided with arrangements for dividing the water into many small currents passing in different directions. The stem L (behind the pointer I) is tubular, so as to serve as one limb of a syphon for emptying the water after an experiment. It passes through a lignum vitæ bearing in the teak cross bar, and is fitted with a wooden handle.

The thermometer must be a good one, as the rise of temperature is purposely restricted to about 3° C. for gas of 140 calories gross calorific power. It should be divided on a fairly open scale to $\frac{1}{10}$ of a degree. It does not appear to us that any advantage is served by a finer division, since $\frac{1}{100}$ of a degree can be estimated with accuracy on such an instrument. The range should be from (say) 0° to 25°. It is seldom that the lower temperature will be approached, as it is best that a temperature of about 15° should be aimed at. But the 0° point is useful in verifying the value of the degree. It is important that when the bulb is immersed to a reasonable extent, the lowest probable reading should be visible above the wooden bridge. We prefer thermometers constructed on the English or French principle, and graduated on the stem; but excellent instruments are made of the German "enclosed" pattern. A reading glass or lunette should be used to magnify the divisions and to avoid errors of parallax. We have found the one used for Boys' calorimeter suitable for the purpose.

The burner is of porcelain, and trumpet shaped. This form favours both the upward reflection of heat and the close passage of cold air currents along its surface. Its low conductivity as compared with metal adds to its suitability. It is fitted on a swinging arm, by which it can quickly be swung under the calorimeter into its position in the combustion chamber. The point of ignition is about ½ inch above the bottom of the chamber, so that the flame is entirely within it. Gas can be burnt at the rate found suitable—*i. e.*, about ¾ cubic foot per hour at a working pressure of ⅛ inch; the head of water being about 2 inches (J to G, fig. 1).

The method of using the holder has been described. A determination is made by filling the calorimeter vessel to the point with water after the thermometer has been put in position, and then stirring continuously, reading the thermometer at intervals of one minute. If the temperature changes, the readings should be noted for 5 minutes (the "initial period" of the Regnault-Pfaundler formula).

A very brief cessation of stirring will allow time to light the gas. Stirring is continued, and only interrupted for the transfer of the burner to the combustion chamber. Directly this has been effected as described above, the temperature will rise steadily; and the rise for each interval can be noted if desired. When the gas is cut off, a slow rise will continue. A period of constant temperature follows, and is succeeded by one of falling temperature. This marks the point at which the "principal period" may end; and a steady fall occurs during the "final period." The method of correcting the observed rise of temperature is given by Huntly.* If the water equivalent calculated from the known weights and specific heats of the parts of the calorimeter be used, the above correction must be made to obtain the best results; but the case for correction can be very much simplified, as shown later.

The cooling system affords a very large surface of highly conducting metal, and consists, it will be seen, to all intents and purposes, of two substances only—namely, copper, the specific heat of which is 0·094, and water, the specific heat of which is (approximately) 1·00. The thermal equivalent of the metal is 4 per cent. of the total; that of the thermometer is less than 0·1 per cent. The only substances touching the cooling system or the base have all a conductivity in absolute units of $0{\cdot}0_8^3$ or less. The burner has a conductivity of about $0{\cdot}0_2^2$. The flame, which burns very steadily at the rate adopted, is prevented from any chance of touching the sides of the combustion chamber or chimney by a detachable metal truncated cone fitting in the chimney. It can be observed by means of a mirror during an experiment.

In the instruments above described, the unavoidable errors are of small magnitude. Some are negligible, and others are amenable to rational correction. We give the results of our investigation of them, and an indication of the relation of the results obtained by this calorimeter and other well-known instruments.

The capacity of the holder can be fixed by either weighing or measuring; $\frac{1}{20}$ cubic foot equalling 1416 c.c., or 49¾ oz. The contact of the water with the pointer is very sharp; and the error with a holder of the same capacity, but a much greater area of cms. section than that shown, was found to be equal to ± 0·09 per cent. of the volume of gas for one experiment. Six deliveries were made through a $\frac{1}{5}$ cubic foot meter lent by Messrs. Sugg and Co. The magnitude of the sum of errors due to imperfect observation of the contact and to slowness of transfer is very small when the bye-pass is used. This reduces the rate of flow by one-half. If the burner is *in situ* two seconds after the actual time of contact the error is only 0·2 per cent. We find one second to be less than the average time of transfer. The error due to this cause is therefore of the order of 0·1 per cent. The reduction of the capacity of the holder due to the flow of water down the side is very small when the bye-pass is used. It is certainly less than 0·2 per cent. The Gas Referees allow a meter to be 0·33 per cent. in error; and it is very doubtful whether greater accuracy can be obtained.

An error, the amount of which has been estimated as a residual error after all others are corrected, of from 1·2 to 1·7 per cent. is due to the absorption of constituents of the gas by the water used in the holder. This error could be removed without giving up the advantages of the Mariotte principle; but, for technical purposes, it is better to allow its amount, which is sufficiently well defined, to be included with other errors in an empirically determined water equivalent.

The greatest divergence between the weights of water in twelve experiments at a fixed temperature was 2·3 grms.; the greatest divergence from the mean being 1·5 grms. The mean error of one experiment was 0·8 grm., or less than 0·04 per cent. of the water

* See "JOURNAL," June 14, 1910, p. 699.

value of the whole system. The approximate magnitude of the sum of the errors due to the coefficients of expansion of copper and of water and the variation in the specific heat of water, is:

Temperature	5°,	10°,	15°,	20°,	25°,	30°,
Per cent. error	−·4(3)	−·21	0·00	+·13	+·4(0)	+·4(3)

when the capacity in grammes is determined at 15°.

The uncertainty of these values, owing to the discrepancies in the figures of different workers for the specific heat of water, is, except for temperatures very close to 15°, of about the same order of magnitude as the mean error of filling. The adjustment of the amount of water is, therefore, sufficiently accurate, if the above table is used, for all purposes, and without it for any technical purpose.

As to imperfect mixing of the water, the ratio of the increments of time and of heat added to the system $\frac{dh}{dt}$ is constant; and therefore the ratio of those of time and temperature, $\frac{d\theta}{dt}$ should also be a constant. This is found to be the case; the curve representing the ratio being a straight line. Mercurial thermometers placed (1) just below the surface of the water, (2) on the bottom, (3) over the cooling-box, and (4) between the central and side chimneys, registered the same temperature within a few hundredths of a degree when the stirrer was used. The amount of this error is negligible.

The water equivalent was determined for the purpose of examining the instrument by weighing the metal portion of the calorimeter, which is practically all copper, with a very little brass and a mere film of nickel and soldered joints. The assumption that it is all copper cannot involve errors of a magnitude worth considering. The value 0·094 was taken for the specific heat of copper. The calorimeter weighed 898·9 grms. Its water value would, therefore, be 84·5 grms. The total value of the system is 2·15 kilos. The metal, therefore, only accounted for 4 per cent. of the whole; and an error of 5 per cent. in its value would only affect the total value to the extent of 0·2 per cent.

As to radiation, evaporation, conduction, and friction of the stirrer, the losses due to the three former causes can be computed for the principal period of an experiment from the temperature changes occurring during the initial (or preliminary) and final (or cooling) periods. The gain due to the last cause is common to all three periods of experiment; and thus its effect is eliminated.

The correction for these errors is much simplified by the fact that, as in Julius Thomsen's calorimeter, the increments of temperature and time have a constant ratio during an experiment, and also by reason of the fixed duration of the combustion. The heating curve, therefore, assumes in any experiment the form of a right-angled triangle on a base of fixed length, adjoining a rectangle (representing the period of a slow exchange preceding the cooling period) also on a fixed base and of the same height as the triangle. The area of this figure, which represents the integral of the increments of temperature is, therefore, proportional to its height—that is, to the rise of temperature. This is the amount to which the correction due to these errors is to be applied. If the correction for a final rise of 1° is calculated, then for all experiments in which the temperature during the initial period is constant, or (say) for all experiments in which the water does not increase more than 0·01° during five minutes preceding the experiment, the correction becomes simply a factor which can be applied indifferently to either the rise of temperature or the water value. It is more convenient to apply it once for all to the latter, by multiplying that calculated by $1 + a$ where a = losses occurring under the above conditions for a rise of 1° ($a = 0{\cdot}01$ or less).

As to imperfect cooling of the escaping gases. These obviously cannot at any time be at a temperature below that of the cooling water, and may be above it. That their temperature is approximately that of the water, the following experiments show: (1) No dew is observed to form on the bright bottom of the calorimeter vessel during an experiment. (2) Readings of a mercurial thermometer with small bulb placed at the gas-exit were—within 0·1° or 0·2°—the same as those of the thermometer in the water. (3) Their final temperature, observed after several minutes' burning, was identical with that observed by plunging the same thermometer in the water at the close of the experiment. (4) Measurements of the difference of potential between the junctions of a copper-constantan couple placed in the water and in the gas-exit, showed that for heat changes higher than those likely to occur in practice—*i.e.*, 1½° rise per minute—the average temperature of the exit gases was from 0·1° to 0·4° higher than that of the calorimeter. The mean temperature of the exit gases may, therefore, be taken as being the mean temperature of the water in the calorimeter during the combustion—*i.e.*, ½ (initial + final temperatures); and no appreciable error is due to this cause.

Losses of heat in the exit gases can be estimated, since their temperature has been defined, by ascertaining the ratio of air and exit gases to the amount of gas burnt during an experiment. The following analyses show that, for gas of the quality supplied in the Metropolis, the volume of exit gases is about ten times that of the gas burnt, and that 10·7 volumes of air pass into the instrument for 1 volume of gas.

	I.	II.	III.
CO_2	5·7	5·4	5·4
O_2	9·8	11·0	12·7
N_2	84·5	83·6	81·9
Unburnt products	—	—	—
	100·0	100·0	100·0

The heat capacity of the products of combustion of 1 cubic foot of gas is 0·1 calorie per degree, or rather less than twice this for the average rise of temperature observed. The heat lost as latent heat in the water vapour accompanying them will vary according to the degree of saturation of the entering and the actual temperature of the issuing gases. For very accurate work, correction can be made as indicated by one of us.* For air two-thirds saturated, which is about the average in this country, the amount of the correction will vary from about 0·6 at 10° to 1·2 at 23°. It is difficult to imagine any other source of serious error besides the above; in fact, we find that results, fully corrected for all directly computable errors except the specific heat of water, &c., differ by a very constant average of 2 per cent. from those obtained on the same gas with Boys' calorimeter working in the most accurate manner, and with Berthelot bomb. Part of this error is due to the alteration of the specific heat of water, and the remainder, as we have indicated, to the solubility of some of the constituents of gas in water. As this error is very constant, it is most convenient to allow for it with that which is due to radiation, &c., by using an empirically determined water equivalent, and to reduce calculation to a simple multiplication of the rise of temperature by a constant value.

The instrument has been made by Messrs. William Sugg and Co., Limited, who have assisted us materially in perfecting it.

Discussion.

Mr. G. N. Huntly said that an instrument of this class would enable small samples to be taken rapidly during the whole period of the make of gas—would enable samples to be taken all over a district for examination at leisure. The instrument had this advantage over practically every other—that if it could not be carried about, the samples could be carried to it. Not many instruments of this type had been described. The only one he had seen was the Hempel; and this he had tried, but did not find very satisfactory. The chief difficulty in it was the very small water equivalent, and the use of a glass containing vessel; and glass was very unsatisfactory for this purpose. As far as could be gathered by him from the condensed description given, the instrument seemed to have successfully and practically avoided all the troubles of the Hempel calorimeter.

Dr. R. Lessing said that an instrument to which different samples of gas could be brought, and which was independent of the locality of the gas supply, was of great importance. One advantage was the small quantity of gas required—about $\frac{1}{12}$ of a cubic foot in all. In an instrument which he was testing just now—namely, a gas-calorimeter devised by Professor Strache—only 30 c.c. of gas were required; and in this even the use of a thermometer was dispensed with, the temperature being measured by the amount of expansion of air in a tube surrounding the explosion vessel. Some of the errors mentioned by Mr. Coste appeared to him to be very small; and they could not seriously interfere with the accuracy of the result. The absorption of gas by the sealing water, which seemed to be regarded as rather serious, might be avoided by using salt or glycerine solution or else mercury as the sealing liquid.

The Authors wrote that, though the error due to the use of the water-seal was of greater magnitude than the other errors, they did not regard it as very serious, as it appeared to be constant. For a technical apparatus, they did not consider mercury a suitable confining liquid, though for the very highest class of work (*e.g.*, the determination of heats of combustion of pure gases) it should be used. They had employed a simple device for getting rid of the error—namely, attaching the tube reaching to the bottom of I in fig. 2 to the gas supply, and allowing gas to flow freely into it; the excess being burnt from a side tube. By this means, air never came into contact with the sealing water, which became saturated with gas. They felt, however, that for most purposes the slight complication thereby introduced was unnecessary. The use of much glycerine would affect the vapour pressure of the water.

SCOTTISH JUNIOR GAS ASSOCIATION.

EASTERN DISTRICT.

The Annual General Meeting of the Scottish Junior Gas Association (Eastern District) was held in the Heriot-Watt College, Edinburgh, on Saturday afternoon—Mr. W. Dunlop, of Kirkcaldy, the President, in the chair.

Annual Report and Balance-Sheet.

The Hon. Secretary and Treasurer (Mr. W. Geddes, of Granton) submitted the annual report of the Council and the balance-sheet. It was stated in the report that the total number of members on the roll was 101, of which 89 were ordinary and 12 honorary members; being an increase of nine of the former and two of the latter. The proceedings during the year were reviewed, and appreciation was expressed of the uniform kindness received by the members at the hands of the companies and corporations whose works were inspected. Thanks were accorded to the honorary members who had assisted in the work of the Association; to Principal Laurie, for the use of the Heriot-Watt College; and to Principal Lumsden, for the use of the Technical College in Dundee. The library of the Association had proved a

* See "Journal," Vol. CVIII., p. 816.

real boon to many of the members; and a desire was expressed that it might be enlarged. Reference was made to the promotion to wider spheres of labour of Messrs. W. R. Herring, J. D. Smith, A. Morton Fyffe, J. D. Keillor, J. Mitchell, and A. Masterton. The balance-sheet showed an income of £36 7s., in which were included £10 15s. brought forward, and subscriptions to the amount of £21 15s. There was a balance of £10 18s.

The PRESIDENT said he considered it was very gratifying that the Association were in at least as healthy a condition as they were a year ago. When they considered that there had been a larger expenditure to make the Association a success, he thought the members might be well satisfied with their work.

The report and balance-sheet were adopted.

ELECTION OF OFFICE-BEARERS.

The following were elected office-bearers for the ensuing year:

President.—Mr. John R. Moyes, of Edinburgh.
Vice-President.—Mr. A. Bishop, of Newton Grange.
Members of Council.—Messrs. R. J. Philp, of Dunfermline; R. B. Chalmers, of Alva; and W. Middleton, of Kirkcaldy.
Hon. Secretary and Treasurer.—Mr. W. Geddes, of Granton.
Auditors.—Messrs. John Davie and J. G. Farquhar.

THE TIME OF THE SESSION.

Mr. D. BISSET (Granton) moved that the whole business of the session of the Association be carried through during the months of October, March, April, May, and June. He said he had been spoken to by some members who considered this would be an improvement; and he agreed with them. A number of the members found it very inconvenient, in winter days, to attend excursions to places, possibly twenty or thirty miles away; and they thought it would be more suitable for the bulk of the members to have the visits altered into the autumn and spring months. The objection might be raised that works would not be seen to advantage on a summer day; but they would be seen during alterations, which would be an advantage to the members.

Mr. A. BISHOP seconded the motion.

The PRESIDENT said he had always thought it would be better to have their visits in summer, which was the best time for most of the members to get away.

Mr. J. R. MOYES reminded the meeting that the matter was brought up once before in the Association, and the difficulty then expressed regarding it was that people would be on holiday in summer, and that the attendances would not be so good. But if they did not go further on in the season than June, it would not interfere very much with the holiday season; and he was in favour of giving the proposal a trial.

Mr. J. MITCHELL (Dundee) considered that June was too far on in the season. He said that in many of the works they visited the workmen were kept on for their benefit; and workmen did not like to give up their Saturday half holiday. He moved, as an amendment, that they continue as they had been doing.

The HON. SECRETARY said he believed that the first session was prolonged into the summer months, and that members did not attend well.

Mr. BISSET's proposal was adopted by 16 votes to 8.

Mr. K. MACKAY (Falkirk) moved that in drawing up the syllabus for next session the Council endeavour to have more meetings and visits.

The PRESIDENT said they would have the same number next session as they had had. He remembered that they were loth to change their quarterly meetings from Edinburgh. But they did it; and the step had been an undoubted success. He believed that the present alteration would be the same. At any rate, it was worth trying.

Mr. MOYES moved a vote of thanks to the retiring Council for the efficient way in which they had carried on the business of the Association.

This was heartily accorded.

Mr. BISHOP moved a vote of thanks to the President; and Mr. T. W. HARPER (Dundee) proposed a similar compliment to the Hon. Secretary, both of which were cordially passed.

Most of the members present at the meeting partook of tea afterwards in the Cathedral Hotel—Mr. Dunlop in the chair. After tea, a smoking concert was held.

Wrought-Steel Pipes for Water-Mains.—In the course of a paper lately read before the Birmingham Association of Mechanical Engineers, Mr. C. L. M'Carthy said the most important requirement in a pipe that was to carry water, air, or other fluids under pressure was reliability. This meant not merely that the pipe should be strong, but that the engineer should have a reasonably good idea of just how strong it was. Mild-steel pipes were the strongest and most reliable, and were gradually taking the place of cast iron, not only for water, but also for sewage and gas mains. Another advantage which the lap-welded steel pipe possessed over cast iron was its increased carrying capacity; the smoothness of the bore reducing the friction, known as "skin friction," between the fluid and the surface of the pipe. This was an important point frequently overlooked, or often underrated. The question of the life of steel pipes had long exercised the minds of engineers, and had been the subject of much conjecture, owing to the fact that there were no data on which to base a rule. All that could be said was that the oldest and best-known steel pipelines were, as far as could be ascertained, in as good a condition and as free from corrosion now as when they were laid.

AMERICAN GASHOLDER CONSTRUCTION.

The last number to hand of the "American Gaslight Journal" contains an article on gasholder construction prepared by Mr. J. ALEX. MAYERS. The author describes and illustrates a 1½ million cubic feet gasholder erected at Harrisburg (Pa.), which presents some novel features of construction.

The bottom plates are 5-16th inch thick, with a 3-8ths inch outer course. By using well-straightened plates of this thickness, and over-all pitch dimensions of not more than 6 feet by 20 feet, buckles were avoided, and a uniformly flat bottom was obtained. The lowest course of tank side plates was 1 inch thick.

The holder was designed for an outlet pressure, when fully inflated, of 8·6 inches of water. The steel tank, which is 143 ft. 6 in. diameter and 35 feet deep, was mounted on a 1½-inch layer of dry sand, instead of the usual sand-cement mixture spread over the top of the foundation. The sand was confined in place by an annular course of grout round the outer circumference, run under the tank bottom after lowering. Sand only was preferred to sand and cement; the latter being held to have more of a theoretical than a practical claim. For its hydration, the dry mixture of sand and cement usually spread over gasholder foundations depends upon leaks and moisture condensing on the under side of the bottom plates and seepage given off from the foundation. Without prior mixing with water, a poorly bonded grout is obtained, at best; while the uncertain and variable source of water supply usually produces irregular patches of cement mortar unevenly distributed. The variable contraction in surface volume may bring excessive strains and occasional leaks at the joints of the bottom plate. If sand only is used, the settling would apparently be more uniform when the full weight of the completed tank and its contents is applied. The actual facts, as observed when old gasholders have been dismantled for re-erection, indicate that a tank usually rests on the bottom rivet heads on the main foundation, and that the confined surface filler relieves the bottom plates between the joints of some of the tensile strains resulting when allowed to act as beams. Dry sand appears to be as satisfactory as, if not preferable to, the sand-cement cakes for this purpose. Forcing grout through the bottom lowering-screw holes, and under the outer rim of the tank, has likewise proved successful, particularly under large holders. But it is usually adopted only where the bottom plates show buckling.

Ever since holders were first built, there has been a continuous effort, and various schemes have been tried, to make the joints between the light sheets gas-tight. Occasionally old gasholders, when dismantled, are found to have strips of lead between them—an expensive and tedious method of construction. Later came the use of sal ammoniac and other oxidizing agents, which were supposed to rust the joints tight, but which when dry frequently worked loose with the motion and vibration, resulting in leaks; or often, through careless or too liberal application, they rusted the sheets through where the deposit was thickest, particularly the plates most frequently immersed, and which deteriorate most rapidly. This custom, practised until recently, gave way to metal-to-metal construction; the seams being made bright by sand-blasting, filing, and wire brushing. The Harrisburg holder has the unique distinction of having been put together gas-tight, with metal-to-metal joints, during the process of erection, with practically no leaks to be caulked when the vessel was tested.

Although caulking is universally employed for making the heavy plate seams gas and water tight, it has not been used for the light sheets of the crown and holder sides except for closing leaks while testing after completion. The side sheets, of No. 10 iron, are usually fastened together with 5-16th inch tapered rivets, spaced at 1-inch pitch; the rivets being driven by hand or air tools. The company who erected the holder make a point of thoroughly caulking all outside seams of both light and heavy plates during erection and before testing; and the practice has proved a desirable one for the purchaser. With specially designed tools, and the labour saved in closing leaks during inflation, this can be done on both large and small holders without exceeding the allowable erection costs; and it greatly diminishes the chances of leakage for the future.

The spherical crown, which has a rise of about 5 ft. 8 in. for the inner lift diameter of 137 ft. 1 in. was very remarkable in this respect, that the 545 plates comprising the thirteen courses fitted perfectly when assembled in position, without a single buckle or inaccuracy of alignment at any of the seams. With the exception of the two outer courses, which were butted, the entire crown was lap-jointed and double riveted; 3-16th inch plates being used.

The sixteen standards of the guide-framing, extending 103 ft. 6 in. above the tank deck, are connected by four tiers of 30-inch web plate instead of lattice girders. Though more metal is necessary, and a slightly greater wind-surface is presented, a stiffer construction is obtained with this design, which is more easily painted than the lattice girders.

The London and Southern District Junior Gas Association will meet next Friday evening at the Westminster Technical Institute, when Mr. W. Upton will read a paper entitled "Some Modern Aspects of Gas." On Saturday, April 8, there will be a visit to the Neasden generating station of the Metropolitan Railway; and on Friday evening, April 28, Mr. Ernest Scears will read a paper on "Oxide Purification."

ILLUMINATION OF SCHOOLS.

It will be remembered that at the February meeting of the Society of Illuminating Engineers, the subject of "School Lighting" was up for consideration—introduction being given to it by Dr. James Kerr, the Medical Officer (Education) to the London County Council, and Dr. N. Bishop Harman, Lecturer on Ophthalmology at the West London Post-Graduate College, and Oculist to the London County Council. The papers were noticed in the "JOURNAL" for Feb. 21, p. 526. The discussion was adjourned till last Tuesday; and there were also promised the results of illumination investigations at a number of schools by Mr. Leon Gaster and Mr. J. S. Dow. This promise was fulfilled on this occasion. To facilitate their explanations, a number of photographic views and tables were thrown on the screen. Mr. Gaster dealt with elementary and other schools in London, and Mr. Dow with technical colleges. A digest of the contributions follows.

The tests described were made with the object of showing the actual conditions of illumination prevailing in various London schools and colleges. With this end in view, a few schools attended by children and infants, some of the large public schools for boys, and a series of colleges, were visited. The data collected refer mainly to artificial illumination. In each case the chief object was to make measurements of the illumination on desks and blackboard. In addition, an approximate estimate was made of the consumption of gas and electricity, as far as local conditions and information available allowed. All measurements of illumination were made with the Holophane Lumeter instrument.

ELEMENTARY AND OTHER LONDON SCHOOLS.

In this class, schools at Haverstock Hill, Charing Cross Road, Richard Street, Islington, and Merton Road, Wandsworth, were visited. The two former are electrically lighted, and the latter by gas. It appears that the conditions at Haverstock Hill are typical of the new electric installations. The artificial illumination on the desks is very uniformly distributed; in this respect it presents a marked contrast with the daylight illumination. The opal shades are specially designed for the size of class-room. They cover the half-frosted tungsten lamps in such a way that one is not able to see the naked filament of the lamp even from the back desks; and the blackboard illumination—over 3-foot candles—is also above the average.

The lighting of the schools in Charing Cross Road is of older date. Carbon filament lamps are still used; and the consumption per square foot is high. Nevertheless the distribution of illumination in the various rooms visited is less satisfactory than at Haverstock Hill.

TABLE I.—*Illumination Data of L.C.C. Schools.*

School.	Nature of Lighting.	Cubic Feet per Hour.	Cubic Feet per Hour per Square Foot.	Illumination (Foot-Candles). Demonstration Table.	Desks.	Blackboard.
	Gas.	Estimated.		Measured.		
RIVERSDALE, SOUTHFIELDS						
Class-room (infants)	Four incandescent burners, Kern No. 4, with opal globes and reflectors . .	16	0·040	3·5	4·5-5·0	1·7-2·0
Assembly Hall	Six twin incandescent burners, Kern	48	0·033	3·2	2·4-3·6	—
RICHARD ST., ISLINGTON						
*Class-room (1)	Four upright incandescent burners, with opal shades . . .	—	0·04	—	1·8-4·5	0·8-2·0
,, ,, (2)	Four twin upright incandescent burners unshaded . .	—	0·08	—	2·2-3·0	3·5-3·9
Large room, used for needlework, &c.	Ten twin upright incandescent burners . . .	—	0·04	—	2·5-3·0	2·3
	Electric.	Consumption in Watts.	Total Watts per Square Foot.			
HAVERSTOCK HILL						
Typical class-room	Tungsten (opal shades) . . .	220	0·5	—	2·0-2·5	3·5
CHARING CROSS ROAD						
Class-room	Carbon (with opal shades) . . .	660	1·2	2·5	1·6-3·0	1·2-2·5
Cookery room	,, ,, ,,	420	1·1	0·75-1·6 (Dresser 0·1-0·2)	1·7-2·5	0·8
Laundry room	,, ,, ,,	480	1·2	1·8-2·8 (Sink and Mangle, 0·4)	0·9-1·8	0·5

At Richard Street (Islington) Schools, which are lighted by gas, the distribution of illumination was found in many of the class-rooms to resemble very closely that at Haverstock Hill. A large number of rooms were visited; and the value of the illumination on the desks repeated itself very consistently. One would be inclined to suggest that the shades used might be exchanged for some form (such as that described by Dr. Harman) in which the mantle is completely screened from the eye. In several cases those at the back of the room could hardly avoid being dazzled by the indirect view of the mantles when looking towards the blackboard. In several class-rooms, complaint was made of the light, and yet the intensity of illumination proved on measurement to be up to the standard maintained in the others. It appeared, however, that in each of the cases work especially exacting to the eyes—such as sewing, shorthand, or reading music—was carried on. It may be suggested that in such cases a higher standard of illumination is desirable, and also that special pains should be taken to exclude anything in the nature of glare. In many cases the increase in illumination might probably have been secured by throwing downwards some of the light which at present escaped and illuminated the walls. On the other hand, it must be recalled that rooms are often used for quite distinct purposes at different times, and must be lighted accordingly.

Another gas-lighted school visited was that in Merton Road. This was mentioned to us as being a new installation. The standard of illumination proved to be well above the average—viz., 4½ foot-candles on the desks. The blackboard lighting, however (1·7 to 2 foot-candles), was somewhat low, as a consequence of the opal shades used. The shades have the merit of almost completely covering the mantle, so that it is not likely to be seen by the scholars.

ART SCHOOLS, TRADE SCHOOLS, &c.

An excellent illustration of the recognition of the need for higher illumination in the case of special work is furnished by the Arts and Crafts School (Southampton Row). The illumination in the various rooms devoted to wood-carving, book-binding, &c., is of quite a different order from that met with in elementary schools. Special devices for the lighting of a compositor's frame, jewellery work, and etching, are required. It is interesting to note that green light seems to be preferred for fine jewellery work. It may be added that throughout this building no case was met with in which the actual source was exposed to the eye; and the illumination, besides being high, was singularly free from glare.

In the Trade School for Girls (Bloomsbury), inverted arc lighting is employed; and it is also very extensively used in the Arts and Crafts School. In other rooms where machine work is done, local drop-lights are the vogue. The local illumination here is again high—from 4 to 8 foot-candles.

PUBLIC SCHOOLS FOR BOYS.

It was also thought of interest to secure permission to take measurements in the class-rooms of a few of the larger public schools; and this was done in the case of Harrow, Dulwich College, St. Paul's, and the City of London School.

The big hall at Harrow is lighted by several chandeliers carrying opal shades and frosted tungsten lamps. The hall is only very occasionally used at times when artificial light is needed. The lamps are high up; but the distribution of the illumination is not very even. Immediately below the chandeliers it is as high as 5 foot-candles, but on some of the back desks only 0·5. However, it was stated that the desks in these extreme positions are not often occupied. In the class-rooms, opal shades and frosted tungsten lamps are used throughout. The average illumination is of the order of 2 to 2·5 foot-candles; but the remote desks sometimes receive slightly over a foot-candle. In summer, no artificial light is wanted; in winter, work goes on until 6.45 p.m. three days a week.

Dulwich College is interesting, because the older part of the buildings is lighted by gas and the newer science buildings by electricity. The big hall, where assemblies take place and evening preparation is also done, is lighted by two rows of twin incandescent burners down the sides of the hall. The mantles are completely covered in by opal globes; and this, while giving a soft and diffused light, also absorbs a good deal. The result is that midway between the lamps there is only about 0·6 to 0·7 foot-candle—much less than that met with in the elementary schools visited. In the class-rooms are inverted opal bowls covering twin incandescent burners, the light being partly transmitted, and partly thrown down by the white ceiling. From the standpoint of absence of glare, the method has much to recommend it. But the illumination is weak—being under 0·75 foot-candle in the case of some of the more remote desks; and the blackboard illumination is also low. It may be added that until two years ago, we were informed, the lighting was all by flat-flame burners.

Carbon filament clear bulb lamps (8-candle power, 205 volts) are used in the electrically-lighted rooms. They are hung in a cluster without any form of shade; and are in the direct line of vision from the back desks to the blackboard. The position is also clearly disadvantageous as regards distribution of light, and inclined to throw head shadows. It is not surprising to find that the back desks receive only 0·4 to 0·6 foot-candle.

The school library is lighted in a rather interesting manner, by inverted electric incandescent lamp fixtures. It was, however, undergoing alterations on the occasion of the visit, so that no tests could be made.

In St. Paul's School the lighting is by electricity. The assembly hall is illuminated by rows of 110-volt tungsten lamps high up on

the battens. This high position is again favourable to reducing the effect of glare; but it leads to a somewhat low illumination over the hall—only 0·7 to 0·8 foot-candle. This room is used for assembly, but only occasionally for classes. In the class-rooms, the order of illumination was about 2·5 foot-candles over the desks; clear bulb lamps with ordinary opal shades being used.

In the City of London School artificial lighting is of minor importance, as work ends at 3 p.m. The assembly hall is in this case never used for class-work. The artificial illumination over the hall is, indeed, too weak for it to be conveniently used for this purpose. The centre of the room is so far from the side brackets that it only receives about 0·3 foot-candle. On special occasions, it was stated that the gas "suns" near the roof, with flat-flame burners, are also lighted; but this is only rarely done.

In the class-rooms the illumination was also low, in some cases only 0·4 to 0·7 foot-candle; but above, artificial light is not much used. Clear bulb carbon filament lamps (200 volts), with ordinary opal shades, are employed.

TABLE II.—*Illumination Data of Public Schools.*

School.	Nature of Lighting.	Consumption in Watts.	Total Watts per Square Foot.	Illumination (Foot-Candles). Tables.	Desks.	Blackboard.
HARROW		Estimated		Measured		
Headmaster's class-room	Tungsten (frosted	125	0·5	3·0	2·0–3·0 1·0 in corner	2·2
Mathematics class-room	,, ,,	250	0·45	5·2	1·5–4·5	1·8-3·0
Mathematics class-room	,, ,,	220	0·5	2·2 1·0 in shadow	1·6–4·4	1·4-8·0
Exam. Hall	,, ,,	750	0·5	1·8to2·6	0·5–5·0	1·6
ST. PAUL'S	Tungsten (opal shades)	245	0·49	5 3	2·4–2·8	2·8
Class-room	Carbon (opal shades)	120				
Assembly Hall	Tungsten (on battens 35 ft. above floor)	2590	0·81	2·0–2·8	0·7–0·8 0·9 under gallery	..
CITY OF LONDON						
Class-room	Carbon (opal shades)	300	0·62	1·6	0·4–0·7	0·7-0·9
Assembly Hall	Tungsten	2110	0·47	1·6 on platform	0·3–0·7	..
DULWICH (Science Bigs)						
Physics lecture room	Carbon	450	0·6	72·0	0·4–1·6	2·0
Chemical laboratory.	,,	600	0·8	2·0	1·1–1·6	..

	Gas.	Cub. Ft. per Hr.	Cub. Ft. per Hr. per Sq. Ft.			
DULWICH						
Preparation room	Incandescent, upright mantles, opal globes	96	0·035	..	0·6–0·8	..
Class-room (1)	Incandescent, semi-inverted, opal bowls	14	0·015	..	1·1–1·5	..
,, (2)	,, ,, ,,	28	0·045	1·0	0·75-2·0	0·7

SOME FIGURES IN GERMAN SCHOOLS.

It also occurred to the authors that it would be of interest to collect, and transfer into British units, some data regarding Continental schools. As an example of these is Table III., which is taken from "Bloch's Grundzüge der Beleuchtungstechnik." Special interest attaches to the high-pressure indirect gas lighting which has been utilized in Münich and elsewhere, and by which excellent results are said to have been attained.

TABLE III.—*Illumination in School Rooms in Germany.*

Nature of Lighting.	No. of Lamps.	Consumption in Cub. Ft. per Hour per Lamp.	Floor Area (Sq. Feet).	Total Consumption Cub. Ft. per Hour per Sq. Foot.	Total Consumption Cub. Ft per Hour per Sq. Ft. per Foot-Candle.	Illumination in Foot-Candles. Mean.	Max.	Min.
Gas.								
Low-Pressure Incand.	52	3·8	1700	0·12	0·016	7·4	8·6	6·0
	14	4·2	1040	0·06	0·0145	4·1	..	..
High-Pressure (Selas)	10	13·2	1700	0·08	0·011	7·0	8·0	6·1
High-Pressure (Millennium)	8	17·1	1700	0·08	0·0115	6·9	8·5	5·8
	6	8·6	840	0·06	0·0095	6·2	6·7	5·3

TYPES OF FIXTURES MET WITH.

With reference to the types of shades met with in various schools, the commonest arrangement consists in the use of the ordinary opal shade and a clear bulb metallic filament lamp. This is almost always unsatisfactory, because the filament is imperfectly shaded; and therefore, when the lamps are placed more or less in the direct range of vision, they are dazzling to the eye. A better arrangement is to have completely frosted lamps. By completely frosting the lamps, the glare is diminished; but a considerable amount of light is lost. Moreover, even a frosted lamp, when hung somewhat low, is probably inconvenient to some extent. A preferable type of shade seems to be that now used by the London County Council, and in use at Haverstock Hill, at the Arts and Crafts School, &c. This completely screens the lamp, which need only be half frosted.

The design of shades for gas lighting has been dealt with by Dr. Harman. In this case also it is desirable that the mantle should be completely screened from the eyes. Except for the loss of light involved, the opal bowls used at Dulwich College are satisfactory. The rooms lighted in this manner have a pleasant "soft" appearance; but the illumination, as stated, was somewhat low. At the East London College the illumination is supplied by Holophane glassware; reflector bowls, hung high up, being used in the lecture theatre with very satisfactory results.

THE LIGHTING OF COLLEGES.

In the case of colleges, the question of illumination assumes a somewhat different aspect. The lighting of lecture theatres, drawing offices, or laboratories presents distinct problems. It may be remarked, however, that, whereas in the case of elementary schools it is often necessary to practise rigid economy, this is less often the case for colleges. Engineering institutions in particular might be expected to do their lighting well, not only because the staff should presumably possess a technical interest in the subject, but also because they have frequently a lighting plant of their own which is more than sufficient to supply generous illumination to the entire building. One would suppose that a lecture theatre, in the design of which special pains are often taken, would be regarded as furnishing an opportunity for special ingenuity in securing the most ideal lighting conditions, and that a pride would be taken in securing the most perfect arrangements. At present, however, it must be confessed that in most cases the lighting is often of a rule-of-thumb order; electric clear bulb lamps with opal shades, at regular intervals, forming the sole means of lighting. Even when frosted lamps are employed, there is a risk of the lights interfering with the comfort of the audience unless their position is carefully determined.

Theoretically, one would imagine that the chief essential in a lecture theatre is, as in class-rooms, the provision of sufficient illumination on the desks, coupled with the avoidance of glaring lights such as weary the eyes of students, and make it difficult for the lecturer to see his audience. The latter condition was rarely satisfactorily complied with in the colleges visited. The next point to be considered would be the desirability of special lighting of the blackboard and diagram sheet, and of the lecture table where experiments are frequently arranged, and which is the central point of interest. Here again it proved to be unusual for special provision to be made for this purpose; and such methods as are used at present are clearly open to improvement. Indeed, the illumination on the lecture table only rarely exceeds that on the desks; the reverse being often true.

In some of the institutions visited—*e.g.*, the South-Western Polytechnic, Westminster Technical Institute, &c.—inverted arcs are utilized for the general lecture theatre lighting. This system, in conjunction with special local illumination for blackboard and demonstration table, has certain advantages as regards distribution of light, absence of glare, &c., and the very "flatness" of the impression, if it serves to accentuate the more brightly lighted parts of the room, may be a merit. It is, however, essential in such cases to select well-designed lamps and good quality carbons; otherwise the flickering and spluttering of the lamps when turned on and off for lantern slides, &c., are apt to annoy.

The general order of illumination in class-rooms is about 2 foot-candles, though isolated instances in which some (even the majority) of the desks received only 0·5 foot-candle were met with

SOME CONCLUSIONS.

It is very interesting to observe that, just as in the case of libraries, the average illumination in school-rooms seems to be in the neighbourhood of 2 to 3 foot-candles; and it may be suggested that this standard should be aimed at and preserved when ordinary class work is to be done. But when extra fine work, sewing, &c., is carried out, a considerably higher value, say 5 to 10 foot-candles, seems to be required. A value of this order is commonly met with in drawing-offices, &c. As has been pointed out by Dr. Harman, the requirements of children and adults differ somewhat. It is particularly vital to supply good illumination for infants and growing children.

The second point that seems to require emphasis is the need for effective shading. There are still far too many cases in which undesirably bright sources of light are left unscreened and allowed to dazzle the eyes of students or children. No unscreened source should be allowed near the direct line of view.

The third point is the need for special local illumination of the teacher's, or demonstration, table and the blackboard. At the same time it is admitted that the present methods of blackboard

WESTMINSTER CITY SCHOOL—THE LIGHTING OF THE ART ROOM.

This room is variously lighted by inverted gas-burners and lamps, which provide a wide range of illumination—from 6 to 15 foot-candles. The model at the distant end of the room is illuminated by an inverted lamp fitted with parabolic reflector. This shows the lines of the model in bold relief.

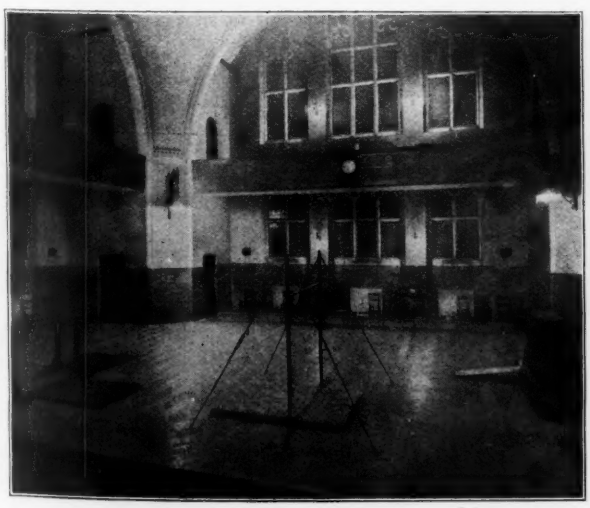
lighting could be improved by scientific study; and there seems a need for some form of fixture which will distribute the light quite evenly and screen the eyes of the audience while doing so.

Resumed Discussion.

Various speakers followed; and in the course of their remarks pictures were thrown upon the screen showing the lighting effects in certain electrically lighted rooms in schools and technical institutions. According to the test-results presented, there appeared to be a large variation in different places as to the amount of illumination (expressed in foot-candles) considered desirable.

Mr. C. W. Hastings (who, as a member of the Council, was in the chair in the unavoidable absence of Professor Silvanus P. Thompson) read a letter from Mr. Wallace Jones on the subject. He thought that, in connection with the subject of illumination, consideration should be paid to the coloring of walls; and he had found a light green was a restful and useful tint to adopt. He urged, too, that electric metallic filament lamps should have their bulbs frosted, so that no portion of the filament was exposed to the eye. Upon this point, the Chairman remarked that he had obtained in practice some very good results from the use of Holophane fittings. In this country, globes and shades of this type had not, unfortunately, obtained such a hold as in America, and especially in connection with the use of gas. But they were now being brought into use by the Gaslight and Coke Company. From the domestic point of view, there was one objection to the Holophane globe; and it was this, that unless it was cleaned it gave lodgment to dust, and so got choked up.

Mr. F. W. Goodenough (London) was the next speaker. He remarked that before giving particulars of tests he had had made of school illumination, he should like to offer a few comments upon the able papers with which the interesting discussion had been opened. He was sure the members of the Society would agree that they were very much indebted to Dr. Kerr and Dr. Bishop Harman for their valuable contributions. With regard to Dr. Kerr's paper, he was not concerned, because it dealt only with daylight illumination; and he (Mr. Goodenough), from the business standpoint, preferred that daylight should be as limited as possible, as he had to deal in artificial illumination. [Laughter.] If, as the result of this discussion, they arrived at a standard of illumination for various types of schoolrooms, lecture halls, and so forth, they would have achieved something which would be of great value to the community at large. The first remark he desired to make on Dr. Harman's paper arose out of his observation that the naked jet was fast vanishing. The fact that he was not able to say that it had entirely vanished was rather a reflection



WESTMINSTER CITY SCHOOL HALL.

The hall has a floor-area of about 2750 square feet, and is lighted by inverted burners and lamps arranged to harmonize with the architectural scheme. The illumination of the floor is practically uniform, and equal to 2·3 foot-candles.

WESTMINSTER CITY SCHOOL CLASS-ROOM.

This photograph shows a class-room having accommodation for thirty-one students, and lighted by four inverted burners, fitted with opal shades. The average illumination found on the writing surface of the desks was 3·35 foot-candles, and on the blackboard 4·7 foot-candles.

WESTMINSTER CITY SCHOOL—THE LIGHTING OF THE CARPENTERS' SHOP.

It contains fifteen benches, and is illuminated by twenty-four inverted gas-burners, arranged on swivel brackets from the stanchions. Opal shades are used. The average illumination found on the benches was 4·5 foot-candles.

upon the enterprise of the British nation. Eight years ago that very day, he (Mr. Goodenough) started on a visit to the principal Continental cities so as to investigate systems of street and other illumination. The first thing that struck him most forcibly as a result of his inquiries was the entire absence of the naked jet everywhere he went to on the Continent; while in this country they were then using probably quite 50 per cent. of naked jets, instead of all being of the incandescent mantle type. Some two or three years after that, he had occasion to approach the War Office with regard to the lighting of one of the barracks in which flat-flame burners were largely in use, and he suggested the use of incandescent burners. He had a reply that the subject of incandescent illumination had been under consideration for some years; and they were thinking of taking action in the matter. [Laughter.] He would say, in respect of scholastic establishments, that the sooner the naked jet became unknown, the better for everyone concerned. He wished to join issue with Dr. Harman on the question of inverted burners. Dr. Harman said the sole advantage of the inverted burner was the absence of shadow below the light. He did not think that the author of this statement had obtained all the information he might have done on the subject of the relative efficiency of upright and inverted burners. Careful tests showed that 33⅓ per cent. more light per cubic foot of gas could be obtained from the inverted gas-burner than from the upright form. This was a substantial advantage of the one over the other. Some tests made by the kind permission of the authorities of the Westminster City School, and at the London County Council School at Barnsbury, showed that where the inverted burner was in use they obtained an average illumination of 4·5 candle-feet, with a consumption of gas per hour of only 3·78 cubic feet per 100 square feet of floor area; while where the upright burner was used, the candle-feet were practically the same (4·4), but the consumption of gas was 5·85 cubic feet per 100 square feet. Comparable results were obtained at other schools, as to which particulars would be given presently. Then Dr. Harman had spoken of the sensitiveness of inverted burners to variations of pressure. The gas supply to every school ought to be governed, so that there should be no variations of pressure beyond the meter. It was a perfectly easy and inexpensive thing to do; and it made for both economy and efficiency. Then Dr. Harman observed that the inverted burner in schools under his observation did not give satisfaction in the average school-keeper's hands. He (Mr. Goodenough) was afraid that burners of any description would not prove perfectly satisfactory in the ordinary schoolkeeper's hands; and it was a great advantage when the maintenance of incandescent gas-burners was placed in the hands of the gas company concerned. The results Dr. Harman gave with different kinds of reflectors were very interesting; and they demonstrated conclusively the value of the new reflector which he had described and illustrated. He (Mr. Goodenough) was sorry to see from the paper that, on the score of cheapness, a compromise had been adopted, instead of the 90° reflector being used altogether. It was a matter of regret that any public authority should go in for a system of lighting that was not the best. And particularly did this remark apply to schools; for their satisfactory lighting was

BARNSBURY (L.C.C.) SCHOOLS—Upright Burners.

BARNSBURY (L.C.C.) SCHOOLS—Upright Burners.

a matter of vital importance to the rising generation. There they found the truly British fashion in the class-rooms of setting the lights more for the purpose of producing symmetry than good lighting. The position of the lights was found to be determined in a very haphazard manner. Desks as well as the lights were, as one of the speakers had pointed out, sometimes rushed in at the last moment; and he did hope that this discussion in which the London County Council, through their officials, had taken so much interest, would lead to this state of things rapidly passing away. There was one point he should like to mention in connection with the tests they had made—that was the question of the difference of illumination they found in some cases between the writing surfaces and the reading surfaces of the desks in London County Council schools where the desks were adjustable, and particularly in the backs of the rooms, the writing surfaces being very badly illuminated in comparison with the reading surfaces there and the writing surfaces in other parts of the room. This, it was believed, was due to the dark dados that were common in the schools, and which had a much more marked effect upon the illumination of the desks in proximity to them, especially when set up for reading purposes, than they did on the desks in other parts of the room. In a particular case, the following results were obtained:

Illumination Foot-Candles.

Writing Surface.			Reading Surface.	
5·1	4·0	..	5·7	4·4
5·5	4·9	..	5·7	4·5
7·2	5·6	..	6·6	5·0
6·8	5·4	..	6·4	4·8
6·4	5·1	..	5·0	3·8*
4·8*	4·5	..	2·7*	2·6*

* Back of room.

The readings in the first and third columns and in the second and fourth columns correspond to the surfaces of identical desks.

This was a point for the consideration of those who were responsible for the lighting of the schools. There was one other point upon which it might perhaps be expected he would like to say a few words, as Dr. Harman introduced it—that was, the connection between lighting and ventilation in the schools. It was a proved fact that where gas was used, it could be utilized so as to very materially assist in the ventilation of schools. In referring to another system of lighting, Dr. Harman alluded to the advantage from the points of view of healthiness and freedom from the consumption of air, and so forth. He (Mr. Goodenough) would be glad if Dr. Harman would get the London County Council to carry out some tests of the atmosphere of rooms lighted by gas or otherwise, or others not artificially lighted at all. It would be highly interesting. Some results had recently been published of tests made by the Medical Superintendent of the Lewisham Infirmary, which tests he made as the result of some trials at the Society of Medical Officers of Health. The results showed that the atmosphere of a ward lighted by gas was precisely as hygienic as—neither more nor less than—a similar ward containing no artificial lighting. There was only normal ventilation in the ward lighted by gas; but the fact that the gas stimulated the ventilation resulted in there being no vitiation of the air. He (Mr. Goodenough) would be glad if Dr. Harman could get the London County Council to carry out some tests on this interesting point. They had had a number of photographs taken of the lighting of schools in the district of the Gaslight and Coke Company; and he would ask his assistant, Mr. Clark, to give the results of the tests which he had himself superintended.

Some photographs of the rooms of schools and technical institutions lighted by gas were then thrown on the screen; and as each one appeared

Mr. J. G. Clark gave some information respecting it. The first photograph, he remarked, was of a class room at the County Council School at Barnsbury; and he stated that this might be taken as an example of the type of lighting in most of the Council schools. It was illuminated by six Kern burners, with squat globes. With a floor area of 750 square feet, the illumination was found to be 2·61 foot-candles. The second view was of a room at the Westminster City School, which was lighted by four inverted burners; the amount of illumination there being 2·36 foot-candles. The burners were shaded by opal reflectors. Another class-room of the same sort at the Westminster City School was lighted by upright burners, and these were also shaded. In this case, the amount of illumination was found to be equal to 2·7 foot-candles. Though they could produce a good light distribution by upright burners, it was more costly than the same amount obtained by inverted burners. In the class-room lighted by upright burners, the consumption was 3·27 cubic feet per hour per 100 square feet; while in the case of the class-room lighted by inverted burners, the consumption was only 1·54 cubic feet per hour per 100 square feet. The next view was from the East Ham Schools. The room was lighted by inverted lamps, set about 30 inches from the ceiling, and shaded by deep reflectors. The illumination there was equal to 3·1 foot-candles. Exhibiting a picture of one of the halls of the County Council School at Barnsbury, which was lighted by upright burners, he said it had an area of 2300 square feet; and the amount of illumination on the floor was equal to 2·25 foot-candles. The diversity co-efficient was very low, being 1·2; and there was practically uniform lighting there. Succeeding was a view of the hall of the Westminster City School, with 2755 square feet area. The illumination, he observed, was again seen to be remarkably uniform—about 2·3 foot-candles, and the diversity co-efficient 1·2. The lighting was by inverted lamps in the lower part, and upright burners in the gallery. The style of lighting was arranged to suit the architecture of the place, and the illumination was very soft throughout. Another hall was that at East Ham School. The area was 2560 square feet; and the lighting was by inverted lamps, having white enamelled shades, hung down the centre of the hall. The average illumination was 2·9 foot-candles on the floor; the diversity co-efficient 1·41. A couple of slides were then shown to demonstrate the general system of lighting the workshops in most technical schools. The first was the workshop at the County Council Schools at Barnsbury. It had, it was remarked, an area of 957 square feet, and was lighted with upright burners, fitted with the new type of opal shade, as described in Dr. Harman's paper. The illumination on the benches was practically uniform, and worked out to 4·4 foot-candles, which, judging from the appearance of the place, seemed to be adequate illumination for the particular work carried on there. The next picture was of a workshop at the Westminster City School, lighted by inverted burners, similar to those used in class-rooms there. They had practically uniform illumination; the average working out to 4·5 foot-candles. They had, as a matter of fact, between 4·8 and 5·4 foot-candles on the benches immediately under the lights, and between 3·6 and 4·2 foot-candles on the benches which were not underneath the lights. Comparing the gas consumption in the two workshops, it was found to be 5·85 cubic feet per hour per 100 square feet for the upright, and 3·78 cubic feet per hour per 100 square feet for the inverted system. Referring to a view of an art room at the Westminster City School, he said the light there was of a mixed character. It appeared to be necessary to have a wide range of lighting; and this had been provided for. It varied from 6 foot-candles up to 15 foot-candles. The model (seen in the picture) was illuminated by inverted lamps, using a bonnet shade; the foot-candles being 10 to 15. In other parts of the room the illumination ran down to as low as 6 foot-candles. The chemical laboratory in the Westminster City School was also lighted by inverted gas-burners; and the illumination found on the benches there was 3·4 foot-candles.

There were several other speakers, among them

Mr. W. A. H. Ryan Tennison (as an architect) inquired how far lights should be spaced from each other. In the schools that he had had to remodel or enlarge, he had generally worked to the rule of the London County Council of 7 ft. 6 in. centres. That was to say, no child ought to be more than 7 ft. 6 in. from a light which would fall on a desk at an angle of 45°.

Mr. John Darch objected to Dr. Harman's suggestion that the least permissible illumination on a child's desk should be 10 metre candles, or (say) 1 foot-candle. He (Mr. Darch) claimed that 3 foot-candles should be the standard minimum for desk illumination; while needlework and such-like required about 8 foot-candles.

Mr. Justus Eck pointed out that artificial lighting engineers had to work in conjunction with daylight; and he saw no reason whatever why buildings should not be designed so that they obtained both good daylight and artificial illumination. With a good, deep white frieze and a light green wall, they should be able to get both good daylight and artificial illumination. He believed in the indirect form of illumination; and he dissented from Dr. Harman's 1 foot-candle. He was quite sure that 1 foot-candle was altogether out of date. In Holland, they had adopted a minimum illumination in their Factory Acts; and it was 2½ foot-candles. Mr. Gaster and Mr. Dow had estimated from 2 to 3 foot-candles; and when there was special work, 5 to 10 foot-candles. They had heard of rooms used for special purposes in certain schools in which 8½ and 10 foot-candles, and even higher than that, were provided. So low a provision as 1 foot-candle would lead them again into the question of glare.

Mr. V. H. Mackinney was of opinion that with 16-candle power lamps placed at 7 ft. 6 in. centres, it was impossible to get above 1 to 1½ foot-candles. In his opinion, indirect lighting was the best if it could be obtained; but it could not be in all cases. The flickering of arc lamps was objectionable in drawing-offices.

Dr. James Kerr, in a few comments on the discussion, said the day of rule-of-thumb in connection with the illumination of schools had passed away. He thought the Society might now go a little farther, and appoint a Committee to draw up some hints for the lighting of schools.

Dr. Harman, referring to the criticisms of the 1 foot-candle, said he ought to have revised that. But the fact was he started this work in the days of the old fish-tail burner. Indirect lighting was a nice ideal, but in practice he had not found it to work well. It was not good where they had close work to do for a long time; and they could not have flickering in a class room. Gas had been much to the fore in the discussion. But he thought the claim that the burning of gas improved the ventilation of rooms had shown itself to be on its last legs. It was conceivable that gas could improve the ventilation of a room if every one of the burners was provided with a shaft.

Mr. Gaster mentioned that Mr. A. E. Podmore had written calling attention to a globe that his firm had specially designed for school illumination.

The Chairman mentioned that the Council would take into consideration Dr. Kerr's suggestion.

There were the usual votes of thanks before the proceedings concluded.

YORKSHIRE JUNIOR GAS ASSOCIATION.

Visit to Leeds Engineering Works.

By the kindness of Messrs. Clayton, Son, and Co., Limited, the members of this Association had the opportunity on Saturday afternoon of inspecting the firm's Moor End and Pepper Road works, in Leeds, and of three other neighbouring engineering establishments with which the Company are closely associated. With the allurement of so comprehensive a system of visits, and the attraction of so well-known a name in gas circles as "Claytons," no one was surprised to find that a goodly muster assembled in spite of very adverse climatic conditions. The visitors, to the number of between 80 and 90, were first conveyed in waggonettes from the City Square to the headquarters of the firm—the Moor End works—where they were welcomed by Mr. Lawrence Clayton, the Chairman of the Company, Mr. Deighton, one of the Directors, and Mr. Baines, the Secretary.

Mr. Clayton expressed the pleasure they had in seeing them, and in throwing open their works for inspection. They regretted not being able to show the works in full operation, but trusted an inspection of even the parts that were standing silent would not be wholly uninteresting. He briefly sketched out the afternoon's proceedings, and touched on some of the features of the business they carried on. The parent firm of Clayton, Son, and Co. made a speciality of holder, boiler, and pipe work. They constructed the first spiral-guided holder ever made (over twenty years ago), and had been making them ever since, as this type was steadily increasing in popularity. Having pointed out and explained a model showing their patent arrangement of guides and wheels for these holders, and the way in which the flanges of the guides were preserved from the undue bearing of the wheels, he called attention to the fine photographs covering the walls, especially to those of the great 12 million cubic feet Greenwich holder, the Granton holders, and a recent one at Montreal, where at one bound the change had been made from the oldest type (a housed holder) to the newest—a spiral-guided one open to the air and all the rigours of a Canadian winter. In regard to the latter, they had had to guarantee its safety and satisfactory working even with a load of 200 tons of snow on the crown. Now that the New York holder was taking away from them their proud record of being the makers of the largest holder in the world, they had achieved another triumph in the completion of the mammoth overhead reservoir at the Tallah Water-Works of the Calcutta Corporation. This was a tank 321 feet square by 16 feet deep, supported by 80 steel stanchions nearly 90 feet high. It contained some 7000 tons of steel, and would hold 9 million gallons of water weighing about 40,000 tons.

Photographs of the reservoir and a specimen of the rolled-steel girders of its supports, 24 in. by 12 in., were then examined, after which the party, under the guidance of various members of the staff, proceeded in detachments to carry out the arranged programme of visits.

The Moor End works were first inspected. These, which are the main works, are devoted to general engineering work, especially in gasholders, boilers, blast-furnace shells, &c., specimens of which were seen in all stages of their construction. Close attention was paid to some of the less familiar and large size pieces of machinery (several having been devised by Mr. Clayton)—*e.g.*, a riveting machine capable of riveting as far as 18 ft. 6 in. along a pipe, a set of six electrically driven drilling machines that needed a minimum of attendance, the special machine for drilling the crown sheets of holders of all sizes, various punching machines, steam hammers, &c. Various parts of holders, particularly the construction of cups and grips, and the firm's weldless trussing, were examined. Many questions were asked about this latter; interest being shown in how it was accomplished. Several sets of coal-hoppers were seen, including some for the East Greenwich coal-handling jetty. One of the great undertakings the firm at present have on hand is the new pipe-line from Lake Thirlmere to Manchester. Some of its "specials" were seen on the works—some strikingly built-up bends, of which it was said that very few indeed were alike—also some shields for protecting these special constructions when placed in unfavourable soil, &c. In examining the riveting of these mains (a point which came up frequently for inspection, both in the operating machines and in the finished article), it was mentioned that these rivets had had an 80-ton pressure applied to them.

The extensive fitting-shops were visited, but not specially examined, as no work was in operation. The visitors then departed by waggonette for the Deighton Patent Flue and Tube Company's works. Here the construction of marine boilers is the speciality; and the steps by which these are bent from the sheet, welded by water gas, and corrugated through rolls were followed with keen interest. This water-gas plant was Messrs. Clayton's first installation, and has been for some years in full and satisfactory operation. The Board of Trade inspection of these boilers was described, and the means shown which are adopted for grinding down roughnesses, so as to see if they were only superficial or indicated flaws.

A move was then made to the adjoining works of the Yorkshire Patent Steam-Waggon Company. This was a little more removed from general gas-works associations, and had therefore in its novelty a special interest. The firm are known over the world for their steam motor-waggons, and several in the shops were for Spain. Two of the special features are the boilers, and the means adopted for tipping out the contents of the waggons. The boilers (made in Messrs. Clayton's works) are placed horizontally across the front of the waggon; and so practically all danger is removed of the readjustment of water level in hill-climbing bringing any of the flues out of the water. The boilers were seen in all stages of construction up to the finished article in its place on the waggon; and the means employed so as to secure a maximum steam-raising efficiency and ease of cleaning out were clearly demonstrated. Various improvements in the waggon supports and tipping arrangements were shown; and one was operated to illustrate how either by steam power or, if that was not available, by easily-applied hand labour, the waggon could be pushed back along its supporting channels, and then slowly tilted so as to eject all its contents over the rear. These waggons are able to climb a hill with a slope of 1 in 7 with a full load of 6 tons, and a hill of 1 in 10 slope with 6 tons on the waggon and 4 tons on a trailer.

Some corporations have these waggons carrying a water-tank fitted with sprinklers for use on the roads in summer, while in winter this tank is removed and the waggon-body replaced, and a reversion made to the originally intended work of the motor. The firm are already making a modification of their motor-waggons, using petrol instead of steam as the motive power. One interesting arrangement was shown on the Spanish waggons. For some of these (using wood as a fuel), stores of logs are kept at intervals along the roads; and when the waggon stops to pick up its fresh supply, a circular-saw and its bench are brought out, connected by a belt to a shaft on the engine, and the logs sawn up into suitable fuel blocks on the spot.

Messrs. Clayton's Pepper Road works were next visited. The firm had arranged for the water-gas plant to be working, and tube welding to be carried on for the visitors' benefit. The process of bending the sheets was seen in actual operation, and two welding plants at work on 40-inch tubes. On the Deighton Flue Works, the welding is done with hammers, here it is accomplished by a cast-iron roll. Tubes of 40 inches diameter and of 18 feet in length and 44 inches diameter and 24 feet long are now being made here from sheets $\frac{1}{4}$ inch to $\frac{3}{8}$ inch thick. The tubes now being made are for the Thirlmere water-pipe line to Manchester; and the water-gas plant and other appliances were specially put down a few years ago to deal with a similar very large contract for the Leeds Corporation Water Department. One water-gas plant is a Dellwik-Fleischer; the other is the Kramers and Aarts system, of which this is the first example in this country.

The final visit, which was necessarily a brief one, was to Messrs. Leech, Goodall, and Co.'s works. Here attention was mainly concentrated on the very fine suite of drawing offices, where plans and drawings of English installations of Dessau vertical retorts were set out for inspection. The Sunderland example was fairly well known; but the drawings of the recently-secured contract for a plant for Hull, capable of yielding 1 million cubic feet per day, were new, and special attention was paid to the small installation for Dronfield, near Sheffield, which is just being put into operation. This is the first example in this country of the erection of vertical retorts in a small gas-works; and the experiment will be followed with widespread interest.

In addition to the names already given, Messrs. Clayton, Son, and Co. were represented by Mr. Hartley, the Works Manager, and Messrs. R. Pickering, jun., Thompson, and Rider. Messrs. Leech and Goodall were both in attendance at their works; while at the Yorkshire Patent Steam-Waggon Company's works were Messrs. Croft, Jarmain, and E. Pickering.

At the close of the inspection of the works, the visitors were entertained at tea by Messrs. Clayton, Son, and Co., at their Pepper Road Pipe Works—Mr. Baines, the Secretary, presiding.

Mr. F. Scholefield, the President, in proposing a vote of thanks to Messrs. Clayton, Son, and Co., spoke of the intensely interesting and stimulating afternoon they had spent. Mr. Clayton had wished they had come when there would have been more to see; but in that case, he could hardly picture how long the visit would have lasted. As it was, they had seen more than they had ever expected to see, and would long remember the day. They had been struck with the wealth of ingenious devices and up-to-date appliances they had seen. They all knew the firm's reputation for thoroughly good work.

Mr. J. W. Lee seconded the vote, and bore tribute to the great kindness of the various guides and other members of the directorates and staffs who had assisted in making the visit so helpful and enjoyable. They would all go back to their more or less humdrum daily work with a new glint of imagination lighting it up; the everyday materials and plant would assume a new meaning as they remembered that they knew how these things were made. As a teacher of gas students at the Sheffield University, he had had occasion to approach not a few gas engineering firms for help, and had never yet been refused, even in his most flagrant importunity. They had gone out of their way to help with models, drawings, slides, &c.; and he wished publicly to acknowledge his indebtedness to them. This day's visits had breathed a similar generous willingness to help the young men of the gas industry. It would leave its mark on their careers; and they united in expressing their heartfelt gratitude, especially recognizing the firm's kindness in having the welding operations in progress for their benefit.

Mr. J. H. Hill contrasted the mechanical engineer's oversight of his machines, and his ability to see exactly how the work was progressing, with the gas engineer's uncertainty in dealing with an invisible manufactured article the very processes of whose production were enveloped in a good deal of mystery and uncertainty. Still, gas making gave scope for the exercise of imagination that was denied to machinery, which mainly called for concentration of mind and accuracy of measurement and judgment. His experience that day of welding by water gas

made him realize that when Mr. Clayton wished they had come when there was more to see, he really meant more to hear; and he for one was content to have come on a Saturday afternoon. He could bear testimony to the high tone of all Messrs. Clayton's business transactions, and to the high standing of the firm. He congratulated the President on this latest illustration of the special interest and value of the meetings of his year of office.

Mr. W. Cranfield endorsed Mr. Lee's testimony as to the unfailing readiness of the contractors of the gas industry to help the juniors in any way tnat presented itself, and especially in their kind assistance to gas classes.

After the vote of thanks had been enthusiastically carried,

Mr. Baines replied on behalf of the allied Companies, apologizing for the absence of Mr. Lawrence Clayton (who had met them on their arrival, but who had not stayed the afternoon out, as he was suffering from the effects of a slight accident), of Mr. Clayton, jun., who had not yet returned from India, and of Mr. Pickering, who was detained by a private engagement. They were happy to meet them, and happy to make the acquaintance of some whose names were already familiar to them. He rejoiced that contractors and gas engineers were not now in opposing camps, mutually mistrusting each other. A brighter day had dawned, they were drawing nearer in friendliness and community of interest. The formation and work of the Society of British Gas Industries, and its co-operation with the Institution of Gas Engineers, were among the encouraging signs of the time. The day was gone—even if it had ever existed—when an engineer was tempted to think of a contractor as an extortioner, and the contractor to think the engineer a fraud. They now realized their mutual interdependence and the value of trustful co-operation. The various firms whose works they had visited had different names, but were all one happy family under the chairmanship of one of the Grand Old Men of the gas engineering industry. Their work was known widely and well; but they had special claims to recollection in connection with the Greenwich twelve-million cubic feet holder that so long held the record for size, that was so dear to Sir George Livesey, and that had so magnificently justified his enterprise and daring. Now they had another record in the Calcutta tank that would take a good deal of beating. The contract had been secured in a world-wide competition on the lowest-priced tender, had been completed before the stipulated time, and had proved entirely successful. Mr. M'Cabe, the Calcutta Engineer, had had many local difficulties to contend against, and had risked much in projecting a work of unprecedented magnitude in its special line. He was very enthusiastic in his praise of their success, and more than proud of what they had done for the child of his imagination. His letter of thanks was a greatly prized tribute to their work and methods.

Mr. Goodall also replied for his firm—the youngest of the family they had that day seen. He joined Mr. Baines in assuring them of the pleasure their hosts had had in meeting and greeting them.

Mr. Thompson also replied, on behalf of Messrs. Clayton and his father-in-law—Mr. Lawrence Clayton.

Gas Companies' Joint Coronation Exhibit.

We have received a copy of the following letter on the above subject which has been sent to all the gas companies within a fifty-mile radius of London, as well as to all gas companies and undertakings to whom inquiries were sent in connection with last year's exhibition at Shepherd's Bush.

I am desired to bring to your notice the fact that a Committee has been appointed to organize an exhibit of gas fittings and appliances at the Coronation Exhibition to be held this summer at Shepherd's Bush. This exhibit will be mainly upon the lines of that organized last year at the Japan-British Exhibition, but the space occupied will be rather more extensive.

Promises of financial support have already been received from a number of companies, including several far afield in the Provinces; and the Committee feel confident, in view of the very general interest that was created among consumers of gas from all parts of the country last year—as evidenced by the large number of inquiries forwarded to the various gas undertakings—that an appeal from them for the general support of gas companies of the country will meet with a ready response.

I shall therefore be very glad if you will be kind enough to bring this matter before your Directors at your convenience, and hope to hear that we may look to your Company for assistance in making this year's exhibit a greater success than that of last year, which was seriously hampered for want of adequate funds.

(Signed) D. Milne Watson, Chairman of the Committee.
F. W. Goodenough, Hon. Secretary and Treasurer.

The Bunsen Centenary.—On the 31st inst., it will be one hundred years since Robert William Bunsen was born; and it has been felt that the occasion should not be allowed to pass without his pupils and admirers in this country giving expression to their veneration of the memory of one of the greatest chemists of our times. A Committee has been formed to make the necessary arrangements; and it was intended to celebrate the centenary by a dinner. Unfortunately, the two most distinguished pupils of Bunsen—Sir Henry Roscoe and Sir Edward Thorpe—are at present prevented by indisposition from attending such a celebration. Under these circumstances, the Committee have decided not to proceed with the arrangements for a dinner; but, feeling that the occasion should not be allowed to pass unnoticed, they have resolved to send a signed address to the Heidelberg University from old Heidelberg students in this country, and to place a wreath on the Bunsen monument. Old Heidelberg students who wish to participate in this movement are requested to send their signatures to Professor H. B. Dixon, at Manchester University.

SOUTH-WEST OF ENGLAND ASSOCIATION.

Visit to Chard.

Members of the South-West of England Association of Gas Managers visited Chard on Tuesday last. They assembled at the Corporation gas-works, over which they were conducted by the Manager (Mr. A. S. Brook). Subsequently they were entertained at luncheon by the Mayor (Alderman S. H. Dening).

His Worship, in proposing the toast of "The Visitors," congratulated the gas managers on the energy and skill which they had displayed in combating the opposition which had arisen in recent years. In Chard, they had had difficulties to encounter. They had great opposition from many quarters when they took over the gas undertaking; and they paid what they considered at the time an enormous price for it. Through the good management of Mr. Brook, to whom he was pleased to pay a tribute, they had got works which were second to none in the West of England. They were paying off the principal at a good rate; and every year they were improving their position, both as regarded the upkeep of the plant and in their finances.

Mr. J. T. Foster, of Exmouth (the Vice-President), responded. He expressed regret that the President (Mr. J. H. Pye) was unable to be present. They congratulated the town on having such good works and so able an Engineer to manage them. They had also very wisely gone ahead by obtaining additional land for improvements in future. Everything they had would carry them on for some time without any great expense; and the results were really very satisfactory.

Alderman Townsend (Chairman of the Gas Committee) remarked that the ratepayers had no cause to regret the purchase of the gas undertaking. They had not raised the rates or made the consumers pay more for their gas; but they had given them 2½ per cent. off their accounts, and hoped that after a few years they would be able to hand the ratepayers a surplus towards the reduction of the rates.

Mr. P. Thomas (Wellington) gave the toast of "The Mayor," and congratulated His Worship and the Town Council on the results they had been able to obtain from their works since they came into their keeping. When they took them over, they paid what one might call a good price; but all was well that ended well. To make a balance of £3000 a year on revenue account required some beating; and there were few works in the West of England with the same output that could show a profit. He believed they had now turned the corner; and there was no doubt in a short space of time they would be able to hand over something for the relief of the rates, and that they would never become a burden on them.

Mr. J. T. Foster presided at a meeting of the Association which followed, and was formally elected President. Mr. A. S. Brook was appointed Vice-President; and Mr. P. Thomas was re-elected Hon. Auditor.

Mr. Brook read some notes on the Chard gas undertaking. He said that gas was first made in Chard by the firm of Messrs. Wheatley and Co., at the Old Lace Mills, in 1837. They also supplied gas to the public; and there being dissatisfaction with their charges, some local people formed the New Gas Company, as it was called, and erected works on the site of the present ones. The Company did not succeed; and the works were subsequently leased to Messrs. Willey and Stone, who also failed to realize very marked success. In 1888, the rights of Messrs. Wheatley and Co. were sold to the Chard Gas Company; and from this time the gas supply had been carried on successfully. The Chard Gas Company in 1902 obtained an Act of Parliament. Personally, he thought the Company made a mistake. Too little consideration was given to the Corporation, besides which it was questionable whether the step was worth taking. It was surprising, when the matter was thought out, how little an Act of Parliament covered in respect to advantages accruing to the possessor. He believed the only valuable right was that they might open-up streets without the governing authorities' consent; while, on the other hand, the rights of consumers were increased considerably, out of all proportion to the advantage named.

The Chard Gas Company, by their Act of 1902, obtained the following clause: "The Company shall not, without consent of the Corporation, raise more than £6000, either by way of additional capital or borrowing under the Act, before Jan. 1, 1904." The Company raised the capital and spent it on the works; and by so doing they improved the working and thereby improved their maintainable profits. The increased profit had a very important bearing on the purchase-price. The expenditure was principally on a holder, new station-meter, tar-tank, boilers, exhausters, and sulphate plant. This in the first complete year of working increased the profits by £300 on residuals alone, and, with £100 additional profit from increased sale of gas, brought the gross profit from £1500 to £1900 in the year 1904—an increase of £400. The Company submitted these increased figures as the maintainable profit on which to base the purchase-price, though they were only granted this borrowing as really necessary to carry on the undertaking until the same could be transferred to the Corporation. The award made by Mr. J. E. Mansergh was 24½ years' purchase of £1418, equal to £40,490 (in round figures); £5250 being for debentures. Now the largest capital the Company ever raised was £22,493, so that the Company did not fare badly. The amount required for the payment of dividend was £1220, based on 4 per cent. interest, which the Corporation paid for their loans. The capital sum of £30,500 would have provided £1220. The Gas Company distributed £35,240.

The progress of the undertaking was seen in the fact that the

sale of gas in 1892 was 9,570,000 cubic feet; in 1897, 15,004,100 cubic feet; in 1902, 19,843,200 cubic feet; in 1907, 26,253,100 cubic feet; and in 1910, 30,450,000 cubic feet. The consumers had increased by 473 during the ownership of the works by the Corporation.

Regenerator settings were installed at the works in 1906; and the results obtained had far exceeded expectations. The cost of the installation was £1982; and the savings effected during three years in coal and wages were £2741, and on coke £490—total, £3231. The installation had been in excess of requirements by four retorts and ironwork, also extra arch and hydraulic main and connections (£482), which should be deducted from the cost mentioned in arriving at a proper comparison as to financial results obtained. The increased make per ton had not been at the expense of candle power. The prescribed candle power was 14, tested by Sugg's No. 1 argand (or such other burner as should be approved by the Board of Trade). They actually supplied 15-candle gas, having a consumer taking over 4 million cubic feet per annum, using jet burners, which compelled them to send out a better quality than would be necessary under other conditions. The installation put in during September, 1906, had made 125,200,200 cubic feet of gas up to the present time, and they were now having two beds renewed, and would renew two more next season—one bed having run continually for 3½ years.

The amount paid off loans was £7500, leaving a capital charge of £50,000 still to deal with, on which 3¾ per cent. interest was paid. The capital charges were not only inflated, but on the point of bursting. The better results were brought about by the Committee adopting new methods of manufacture and distribution.

Some twelve months ago, pressure-lighters were installed of the Elton Stephens design. Mechanically, the system was a great success. It was sure of action, repairs were *nil*, there was no winding and no clockwork, and under proper conditions it did not fail. But there were troubles outside the lighter itself. Naphthalene was no friend, windy weather interfered with bye-passes, difficulty arose from sudden pulls on the main by reason of stormy and early nightfall, and then there was the least pressure at night, where they had the heaviest in the day time, and pulsation in the mains by reason of gas-engines. The makers overcame all that was possible, and the guarantee that not more than 1 per cent. would fail per movement was amply borne out in practice.

Mr. Hockey, a member of the Town Council, in the course of the discussion, asked the members whether they considered incandescent lighting the best for the streets.

The Chairman said he was strongly in favour of incandescent lighting. The trouble they might have occasionally with this method was very little. They should have the best class of burner and mantle they could obtain.

Mr. G. H. Appleyard (Sidmouth) also thought lighting by the incandescent method was the best. In hot weather, the burner might become choked through hundreds of little flies getting into it; and spiders would spin their webs over the air-holes.

After the meeting the members visited the works of the Phœnix Engineering Company; and the proceedings concluded with a tea, given by Mr. Brook.

CONSTRUCTION, COST, AND MANAGEMENT OF SMALL GAS-WORKS.

By J. J. Scott, of Kennoway, N.B.

[From a Paper read before the Scottish Junior Gas Association—Eastern District—March 18.]

The planning and construction of small gas-works, capable of producing (say) 15 million cubic feet per annum, is not the easy job it looks, especially when the cost has to be kept down to the lowest; and it would, perhaps, baffle the highly trained and skilful gas engineer if he were asked to lay down a 15 million works, including 5 to 6 miles of main-pipes, 400 to 500 services, and an equal number of meters, for the sum of £6000 or £7000. Yet, with the introduction of good second-hand plant, and the services of a practical gas engineer, this can be done. The selection of the site—where selection can be made—is a very important point. It is advisable to keep away from the flat site. Rising ground always lends itself to the easier and cheaper handling of material; and given sites similar to those of the two works at present under my charge—both of which are quite close to railway-sidings—the ideal for a small works is almost realized.

The retort-house should be a fairly commodious building, serving as a retort-house, coal-store, and boiler-shed all in one. A lean-to roof against one side of the retort-house forms an excellent exhauster-house, workshop, and stores at a minimum cost; and this, with a meter and governor house, is really all the buildings required. A retort-bench and gasholder are the main, and more expensive, parts of the plant; and money should not be too sparingly spent on these items. The remainder of the plant—such as bench mountings, condensers, exhauster, scrubber, purifiers, meter, and governor—can often enough be obtained second-hand, as so many of the larger works are growing at such a rate that they are compelled to replace splendid plant with larger apparatus, thus throwing on the market an excellent selection of good plant. It is here that the practical gas engineer excels. He knows exactly what to buy, and what to avoid. He has possibly managed such a works in his time; and his practical knowledge is most valuable. Main-pipes, service-pipes, and meters are a serious item in the cost of small gas-works. Long, straggling villages, with houses scattered all over the place, entail much expenditure; but the size of pipes should never be allowed to suffer.

The two works under my charge are both capable of producing 15 millions per annum, and, with the exception of some parts of the plant, are similar to each other in design. They are erected on sloping ground; and the retort-house being suitably placed, the coal is tipped by cart at a high level into the coal-store, enabling us to lay in something like 150 tons of coal without handling. As both the works are near sidings, we are able to get the coal taken from the waggons to the coal-store for about 6d. per ton. Under these circumstances, a railway siding into the works would never pay.

The retort-house measures 40 feet long by 48 feet wide, and is built of substantial brickwork, panelled in design to relieve the plain appearance, and covered by a strong corrugated iron roof. There are two settings of retorts—a six oven and a three oven; the latter to hold five retorts when required. They are of the shallow regenerator principle (Brown's patent conduits), and give excellent results; and they are possibly preferable to the generator principle, though a little more difficult to manipulate. They are fitted with self-sealing doors, and large diameter ascension and bridge pipes, which are also a great advantage in successful carbonizing. At the end of the retort-bench the steam-boiler, which is a Cornish one, is built in with a flue connection to the main flue of the bench. It is a great advantage to have steam in a small works for other purposes than power—namely, cleaning out foul mains and connections in summer, and preventing frost troubles with the holder and other parts of the plant in winter. The condensers in one case are of the ordinary atmospheric type; while in the other we utilized two 16-inch steel tubes by fitting them with cast-iron end-pieces and filling them with 1¼-inch tubes, thereby making a splendid set of water-cooled condensers. Meantime, the make of gas is so small that we are working them perfectly as atmospheric condensers. In both works exhausters have been used since the first day. They were both purchased second-hand, and are of ample size for a long time to come. On one of them was fitted a hydraulic steam-regulator; and this has given us much satisfaction—so much so that I have decided to have the other fitted up on the same principle. The cost, however, has to be reckoned with; and to keep this as low as possible, I procured a disused compensator bell and tank, which I propose to fit up with a Bryan-Donkin steam regulating-valve, thereby reducing the cost from something like £14 to about £4 or £5.

At one of the works we have a Holmes rotary scrubber-washer; while at the other we have a Livesey washer—both splendid pieces of plant for a small works. The purifiers are three in number, 10 feet square, and 3 ft. 6 in. deep, and can be worked in any sequence. The gasholders are of 50,000 cubic feet capacity, with steel tank, and are on the spiral-guided system—both being prepared for a second lift. They are set on a concrete foundation, about 20 inches thick. A station-meter and station-governor, both of ample size, and erected in the same house, complete the list of apparatus of two fully-equipped gas-works.

The costs, in round figures, were:

Buildings	£671	Main-pipes	£1636
Plant	2489	Service-pipes	634
		Meters	834
	£3160		£3104

The works are only making about 5 millions each at present, thus causing our capital expenditure to be something like £1200 per million, which is a very high figure; but as the make of gas will rise rapidly, the cost per million will get less, until a reasonable figure is reached.

Coming to the management of small works, one has to be prepared to deal with many duties arising in the daily routine; but possibly the retort-house commands the major part of one's attention. The retorts are 9 ft. long by 21 in. by 16 in., ⌂ shaped, with self-sealing doors. While working the three ovens with 2¼-cwt. charges, our make averaged 8750 cubic feet per ton of coal carbonized; and thinking this could be improved, I resolved to have the seal on the dip-pipes reduced. Finding, however, that I could not get anything less than 1-inch seal, owing to the seal-valve being set high on the main, I got three spare dip-pipes, had them cut to a suitable length, turned to a knife-edge, and fitted in. Starting with a heavy seal to begin with, I gradually reduced it to as low as was safe to work with—about ½ inch—and I found this helped the make per ton a great deal. I gradually increased the weight of the charge; and now I am working with 4-cwt. charges of six hours' duration, and the make per ton for the three months (ended January last) was no less than 10,132 cubic feet. After working with the heavy charges for some time, I have found it to be an advantage and an economy. The full benefit of the heat generated, and the full use of the retorts, is obtained; while the wear and tear of the retorts is reduced to a minimum. The carbonizing wages are kept down by being able to do without winter assistance for a time at the beginning and the end of the winter season. The stoker has also more time to attend to the yard, boiler, exhauster, and scrubber, and for cleaning out the purifiers and filling the tar and liquor barrels.

Referring to the make of gas per ton in small works where the

retorts are damped down at night, a great amount of gas is lost by doing so. I made experiments on different occasions. Charging the three retorts three times a day, and using the same quantity of coal each round of charges, I found that the make of gas turned out as follows:—

First round	4100 cubic feet.
Second round	4700 ,, ,,
Third round	4800 ,, ,,

The total quantity of gas made for the nine retorts was 13,600 cubic feet; and if the oven had been working constantly, the make would have been 14,400 cubic feet or so. This is one important point the manager of a small works must submit to, and one which he cannot very well alter. I have always found it to be a good plan to test a quantity of coal occasionally; and the figures one gets from such tests are interesting, and almost necessary. When getting in a supply of coal, I order 50 tons at a time, and note the date, the index of the station-meter, and the stock of coal lying when the new lot comes in; and by checking the stock and the index of the meter, the quantity of gas per ton can be shown. By doing this, the manager is able to know the quantity of gas per ton, the quantity of coke, the quantity of tar and liquor, the amount of ash, and other particulars, all of which are important to know when contracting for next year's supply. When coal comes in on the "waggon per week" system, from two or three different places, it is impossible to know the qualities of various kinds used.

A small works is seldom fitted with a retort-house governor; and in running the exhauster, especially where there is no steam regulating valve to control it, care must be taken not to overdraw the seal. I find it an advantage to work with about ½ inch of draw or vacuum; and I have not had any trouble so far. I keep the exhauster running during the night, giving it a look at the last thing; and it is quite uncommon to find it at a stand-still in the morning.

In working the scrubber and washer, I fill them up with clean water, and work up to the necessary Twaddel strength to sell; then empty, and refill. As this residual is an important source of revenue, there is no necessity for working up the strength beyond what is specified by the buyer; and in using water instead of liquor, one can always increase the revenue under this head. At one of the works the engine driving the scrubber uses a great deal of steam; so I decided to run the scrubber for two hours only after the retorts had been charged, thereby saving a good deal of fuel and losing very little ammonia.

I have used oxide material for purifying since the works started. In working, I have two boxes on and one off, and lay the oxide in two layers; the bottom layer being 15 inches thick, and the top about 10 inches thick. I have just bought an air-meter from a works where they are fixing a rotary blower; and I intend fixing this meter up, and so having the assistance of air to revivify *in situ*. Referring to the important attention purification methods are receiving in large works at the present time, though the same methods are applicable to small gas-works, yet I think that the majority of managers of small works are too busy to devote the necessary time and attention required.

In checking the station-meter, which is done the first thing in the morning, I also take a note of the stock of gas in the holder by means of the rivets; and knowing the capacity of the holder per rivet, I am able to tell exactly how much gas has gone out during the previous day—by adding to or subtracting from, as the case may be, the amount made. The trouble entailed in doing this is worth while, because an exceptional fluctuation on the output can generally be accounted for; and, if not, it causes one to give attention to the distribution. In this department, leakage is a serious problem to all gas concerns, and especially in the small works, where possibly the pipes were laid forty or fifty years ago, as in my own case, and second-hand pipes at that, and have never received any attention, unless where the pipe was broken or split, and was repaired by being smeared all over with white lead and tied up with a workman's handkerchief.

At present, when high pressure on the district is necessitated by the introduction of cookers, grillers, fires, &c., the trials and troubles of the manager are by no means lessened when he has to deal with such mains as I have just mentioned.

I always keep the pressure on the district the same night and day, because of the number of cooking stoves in use; and it also helps one to find out leakage more readily. When regulating consumers' burners, &c., too, it is an advantage, as when doing this work with a low day pressure it is almost impossible to regulate properly to suit the higher night pressure.

I was able a short time since to get a wooden office and showroom built on the works site at a very small cost; and by keeping it open all day, the sale of incandescent burners and fittings, &c., has of late greatly increased. It is an advantage also to have it available to receive orders, and for consumers' paying accounts, hiring-out cookers, inspecting fires, &c. I have been able to keep a gas-fitter doing fitting and maintenance work, including the fixing of cookers, meters, grillers, and attending to the street lamps, in constant employment; and I believe if his services to the consumers were dispensed with, the gas sales would certainly not be as good as they are.

Street lighting is a good outlet for gas in small works, though sometimes the price has to be lowered a little. Two years ago I was asked to give an estimate for the street lighting of Kennoway, and also for Windygates. The Gas Company submitted estimates to light with the torch, and also with Alder and Mackay's automatic gas-lighter. After giving some demonstrations with the apparatus, both Committees decided on the automatic system as the best and cheapest. The extra pressure we had at our disposal to work the apparatus was only 7-10ths, which was found to be insufficient, especially as the two districts were extinguished at different times, causing an extra actuation of the pressure-wave. Some other means had, therefore, to be looked for; and as a booster or rotary fan was out of the question, on account of the heavy expense, I devised the following arrangement whereby I could use the works exhauster to give the necessary pressure.

Upon the inlet and outlet connections to the exhauster were two blind flanges. These I replaced with reducing flanges from 8 inches to 3 inches, and put a rack-and-pinion valve on each. Next to the valves I put in two T-pieces, with the off-sets looking towards one another, and placed a safety or bye-pass governor between them. I took a 3-inch connection from the inlet to the holder to the inlet of the exhauster; and the 3-inch outlet I connected to the street-main, inside the works. To create the pressure-wave, I simply open the valve leading to the street-main and close the one leading through the plant to the holder, thereby directing the gas wholly to the street-mains. If the make of gas at the moment is not sufficient to supply the exhauster, the valve on the pipe from the holder is opened to make up the deficiency. A few revolutions of the exhauster are sufficient to operate the apparatus; and the bye-pass governor keeps the mains from being overcharged. The station-governor automatically closes itself, and prevents any gas passing back to the holder; and it also automatically opens as the pressure leaves the district. It is the case, of course, that foul gas is being pumped direct to the town; and to overcome this difficulty, I pass the gas through a small home-made purifier, which was really an old 5-inch water-trap. The arrangement is thoroughly successful, as the working results of the automatic apparatus show. During the past five months, there have been 453 actuations of the pressure-wave working 72 appliances; and the number of failures was 37—being 0·11 per cent. on the total, or one failure for every 890 actuations. Then 35 bye-passes were out, and 22 back-lighted. Some 266 mantles have been used, equal to 3·7 mantles per lamp.

We held an exhibition of cooking and lighting at the opening of the new works at Kennoway; and now two-thirds of the consumers have cooking-stoves of some description fitted up. Advertising always pays, no matter how simple the form may be. Our works are situated near the main road; and on a grassy bank inside, I had the words "Cook with Gas," painted in whitewash, in large letters. It was simple, but effective, as no one could pass without seeing it.

Discussion.

Mr. R. B. Chalmers said he had been interested in the part of the paper in which Mr. Scott mentioned repair with white lead and a red handkerchief. There was a great deal of this. Some years ago, they had a main laid; and they afterwards found there was not a single joint caulked. The lead was run in with a piece of cloth, and sometimes with a bit of clay. How did Mr. Scott check small sales of coke?

Mr. A. M'Lean (Queensferry) inquired what method was adopted in charging for the gas consumed in the public lamps.

Mr. H. E. Doran (Granton) asked if tar accumulated in the purifiers; and how long the purifiers worked.

Mr. R. J. Philp (Dunfermline) wished to know what kind of burners Mr. Scott used for the street-lamps, and what was the length of the season. The number of mantles per season was very small, as compared with the usual experience.

Mr. J. Mitchell thought a good way, when getting in coal, was to have a small weighing-machine, upon which every barrow before it went into the retort-house, and the coke as it came out, could be weighed. By this means, they could strike a pretty fair estimate of the quantities handled, and tell what their sales were.

Mr. K. Mackay asked what percentage of coke was used in the regenerators.

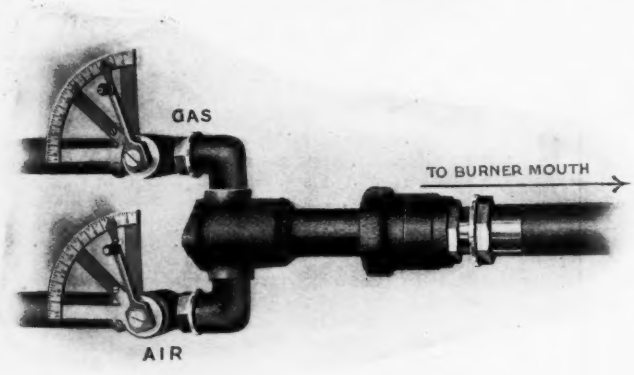
The President considered Mr. Scott's paper a most suitable one for an Association like theirs. He agreed with the author that steam was very valuable in small gas-works. He often wondered what a gas-works would be without it. Even though there were no chokes present, he believed it was beneficial to give gas plant a steaming now and again, as it prevented chokes arising. He would have thought that in the brush scrubbers Mr. Scott, instead of using clean water in both, would use liquor in at any rate one of the chambers, and so secure the benefit of the purification which would take place through the liquor. Mr. Scott had a very ingenious way of obtaining the pressure-wave for lighting the street-lamps. He might tell them what pressure he had at the outlet of the exhauster, for instance. The securing of a steady pressure the whole 24 hours was becoming a very general idea. Incandescent burners were supposed to be self-governing; but he had found that, if the pressure were altered, or if they had a range of pressures, they did not obtain uniform results. Where they had a burner served with a steady pressure, they obtained the best advantage out of the burner.

Mr. Scott, replying to the questions which had been asked, said the stoker sold the coke during the day; and in the evening he handed over, in the office, the cash he had drawn. If there were sales not paid for at the time, they were marked upon a slate. He had a contract for the lighting of the street-lamps at so much per lamp. They used "C" mantle-burners, with 3-feet governors. He had been very free from tar in the purifiers. He ran a purifier for about two months clean. Then he turned it on as first purifier, and ran it for about another two months. As to

saving wages in carbonizing, it did not require much extra labour to put 4 cwt. instead of 2¼ cwt. of coal into a retort. They secured an average of 1875 cubic feet of gas per retort per charge. When they could turn out 15,000 or 16,000 cubic feet from nine retorts, it would be seen there was a saving in wages when compared with 16,000 cubic feet from fifteen retorts. He saved a man's wages for three weeks at the beginning of the season and three weeks at the end, or six weeks in all. The lighting season ran for six months. The figures he gave were for five months, ending with February. He used about 50 per cent. of the coke for the furnaces; and the rest he employed for the boiler and for sales. It required a considerable amount of gas to boost from 25-10ths up to about 5 inches. The apparatus he had was loaded down to 5-10ths maximum pressure on each lamp; and he increased this to about 25-10ths by working the apparatus as he had described. The holder pressure was only 3¼ inches; and he boosted up to 5 inches. If it were near the end of the charge, and little gas was coming off, they could not get gas enough, and they were obliged to take a supply from the holder for boosting.

BRAYSHAW'S HIGH-TEMPERATURE BURNER.

In view of the interest that is being evinced in the utilization of coal gas in the metal melting and similar industries, opportunity may be taken to draw attention to the Brayshaw patent burner, which is specially suitable for use where high temperatures are required, and so is applicable for melting, hardening, annealing, and general furnace work. The burner (of which the accompanying illustration gives a good idea) is suitable for employment with either coal gas or producer gas, and is the result of prolonged experience and experimenting in order to obtain the maximum efficiency. The gas and air are independently regulated; while it is claimed that the arrangement of the burner causes such an intimate admixture that perfect combustion is assured. Being designed and constructed with all the care and accuracy of a steam-injector, the burner is able to give a flame



Brayshaw Burner for Coal Gas or Producer Gas.

which is effectively "reducing" without a wasteful excess of gas. This, it is pointed out, is of the highest importance in the heating of steel and other metals whose surfaces are liable to oxidation and blistering. The Brayshaw burner is being used by some of the largest firms in the country; and among other places where it has been adopted is the Royal Mint, London—with regard to which installation the following figures of a melting are furnished: Total time from lighting-up gas to turning-off for four furnaces working together, 27 hrs. 40 min. Total weight of gold melted, 257,052 oz. Total consumption of coal gas, at a pressure of 3 inches of water, 32,000 cubic feet. The burners are, it may be remarked, made to work with gas at any pressure from ½ inch of water, and with compressed air at a pressure of only 1 lb. or 2 lbs. per square inch; they are as far as possible noiseless; and they can be had in various sizes, to burn from 50 to 1000 or more cubic feet of gas per hour.

The maker—Mr. S. N. Brayshaw, of Mulberry Street, Hulme, Manchester—has details of prolonged tests which have proved that, for crucible furnaces, coal gas consumed with his patent burners is much more economical than coke. He also builds special furnaces for melting, hardening, &c., to be used in connection with the burners.

Opening Roads without Statutory Authority.

The action of *Attorney-General v. Hawkins and Another*, which was brought to restrain the defendants from interfering with and breaking up the roads in the area of the Padstow Urban District Council [see *ante*, p. 538], came again before Mr. Justice Swinfen Eady, in the Chancery Division of the High Court of Justice, last Friday. Mr. Macmorran, K.C., stated that since the matter was last before the Court the parties had come to terms. It had been arranged that the motion should be treated as the trial of the action; the defendants consenting to an order in the terms of the writ, and undertaking to pay the costs.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Efficiency of Gas-Boilers for Domestic Uses.

SIR,—Will you kindly allow me to make the following comments, which I will render as brief as possible, on your correspondent's letter in reply to mine of March 2 [*ante*, p. 703], *re* the above matter?

The most noteworthy features in his letters are the tone of superiority he adopts (why, I fail to see) and the "compliments" with reference to my experience and tests—all very amusing, but of no assistance in his attempt to prove his arguments. It is noticeable he deals with my last rejoinder more or less in a vague manner, avoiding reference to definite statements based upon concrete facts. He also ignores my challenge to him to substantiate his statement in regard to the apparatus he used for the test as being "my" combined boiler and storage apparatus.

His remark as to my "advertisement" should certainly have been left out, seeing that your correspondent himself commenced this controversy in his paper by so criticizing my boiler, among others, that my attention was called to it outside my firm (as pointed out in my last letter). I then refuted such criticisms, knowing them to be wrong (which I presume was within my rights), as briefly as possible by my letter of Feb. 15 [*ante*, p. 534], to which your correspondent replied in such a supercilious manner that it left me no alternative but to write at length to substantiate my previous brief statements, &c.

I find among his remarks reference to the question of my "testing-principles," which, owing to the many items to be mentioned in my last letter, I was then unable to deal with, except to call attention to his grave misconception regarding Test No. 6 (which appears to be a perfect *bête noir* to him); and in referring to this subject, together with the question of thermostats, which I have so far been unable to deal with definitely, I beg your indulgence upon this occasion.

Mr. Yates continually puts forward the suggestion that, to get reliable and proper information in the matter of testing, experiments and tests should run over extended periods, and we have known him to advocate a test of even twenty-four hours' duration. We put it to him, however, that a cast-iron boiler which will meet a certain purpose in one hour will repeat it for any number of hours with slightly better results after the first hour, due to the heat absorbed by the apparatus at starting being provided for; and as with a properly-proportioned installation the boiler should be capable of heating the entire storage within one-and-a-quarter hours or thereabouts (according to the time of the year), there is no need to extend such tests for the purpose of calculating the capabilities of the boiler, except, perhaps, for supplying successive baths, or for the measurement of heat losses from the apparatus (supposing the system is not covered), which, however, in the latter case does not concern the boiler in itself. For this reason, the capabilities of boilers should be ascertainable in the manner I have stated: and failing their meeting such purpose in this way, they would be deemed unsuitable for domestic hot-water supply. I am surprised that Mr. Yates, with his "long and wide experience," has not realized this before; for daily contact with the question proves that prospective users do not, as a fact, ask: "What will your boiler do in 24 hours?" but "How soon can I get a warm bath?" or "How soon can you give me hot water for sink use?" When he and his staff, however, are brought into daily contact with this branch of domestic equipment, in so far as it relates to independent gas-heated boilers, they will then no doubt change their ideas as to the correct methods of testing such appliances from a practical standpoint.

On the subject of tests, I should like to mention that those put forward by me, which he asserts are "figures purporting to be tests," were, in the majority, made by different gas companies for their own investigation as to comparisons of boiler efficiency, and had nothing whatever to do with this controversy. The figures in these instances were read off by their own staff and, when I was not present, confirmed to me in writing. Had Mr. Yates not rendered this controversy necessary, the fact of these tests (which were both "scientific and practical," also unbiassed) being in my possession would never have been known outside my firm and the companies in question.

Mr. Yates further says his paper was not written for controversial purposes. This I think is quite possible; for had it been so intended, more care would have been exercised in the so-called scientific comparisons and formula adopted. As the information was offered, however, he disparages my boiler (among others), and adopts an unpractical form of apparatus with it (represented as mine) for comparison with another make of apparatus (incidentally one he is interested in), and asks his readers to take it for granted, unchallenged, that the combined boiler and storage apparatus he refers to is more efficient than the separate arrangement.

Does Mr. Yates assume that it is his privilege to publicly place other makers' goods to disadvantage in comparison with those he is interested in, and that the firms in question should meekly allow their goods to remain under the ban of his criticism? If so, I notice from your columns that I am not the only one who thinks differently on this point; and for a man to adopt such a course in reading a paper displays not only a very peculiar "dispassionate spirit," but a savour of presumption. I am glad, however, to note that he now admits my boiler has some "merits"—a concession certainly on his part after his criticism.

So far as the question of heat losses from the separate arrangement is concerned, this is not necessarily any more than with the combined system, provided a secondary circulation is non-existent, as the storage can be just as easily jacketed where the cost of so doing permits. Therefore, the combined arrangement has no superiority over the separate system in this respect, which proves the fallacy of one of the few definite statements contained in your correspondent's letter.

In spite of the fact that there are other points in his letter to which I should like to refer, I fear that I must not trespass on your space any further; and therefore, with the foregoing remarks, this controversy, so far as I am concerned, closes, unless Mr. Yates' further comments render it necesssary for me to trouble you again in the matter.

Balham, S.W., March 17, 1911. THOMAS POTTERTON.

Gas-Heated Ovens for "Standard" Bread.

SIR,—The following may be of interest to those of your readers who possess a gas-heated oven and a supply of "Standard" flour.

Home-made bread has, in England, almost disappeared. The great economy is not so well known as the fact that the ordinary range oven is a very uncertain and troublesome arrangement, which makes the result of baking a doubtful matter. The trouble with the oven has been the greatest factor. But now, fortunately, this is done away with. It will be found that 4 lbs. of best "Standard" flour, at present prices, cost 6½d.; and this with one pennyworth of yeast, will make 7½ to 8 lbs. of best "Standard" bread, far better than any shop bread which can be bought. This quantity can be baked to perfection in a gas-oven, at a cost of 1d. for gas. We have thus a total cost of 8½d. for 8 lbs. of bread, as against 1s. 1d., the present shop price. The cost of using a gas-oven is in direct proportion to its size; and, where economy is necessary, the size of each baking must be proportioned to the size of the oven. If an oven will hold four loaves, the cost of baking two in the same oven is practically the same as when four are baked at once; but, even if it is only half-filled, the economy is very considerable.

Warrington, March 18, 1911. T. W. FLETCHER.

Circulars of Inquiry.

SIR,—You have had occasion, from time to time, to call the attention of your readers to "laudable" efforts on the part of outsiders to obtain professional information at a cheap rate.

The enclosed copy of a letter received by my Chairman may be of interest, if only as an exhibition of ignorance on the part of its writer.

Carlisle, March 18, 1911. HAROLD E. BLOOR, B.Sc., B.Eng.

[ENCLOSURE.]

City Engineer's Office, Toronto.

The Chairman of the Gas Committee.

Dear Sir,—Will you kindly let me know, by return of mail, what are the calorific values of gas in British thermal units.

(Signed) JOHN PEARL, Inspector.

LEGAL INTELLIGENCE.

ACTION IN RESPECT OF A TAR CONTRACT.

In the King's Bench Division of the High Court of Justice, last Wednesday, Mr. Justice SCRUTTON had before him an action brought by the Tottenham and Edmonton Gas Company against Messrs. Hobman and Co. to recover £59 19s. 5d., the balance of an account for tar supplied. The defendants did not deny the price or the quantities delivered, but said that 10,892 gallons, part of the last two deliveries, were not in accordance with the contract; and by counterclaim they sought to set off the £59.

Mr. HUGO YOUNG, K.C. (with him Mr. O. DAWSON), who appeared for the plaintiffs, said that, for the sake of peace, he was willing to make a small allowance, but certainly not £59. The contract was for coal-gas tar free from ammoniacal liquor. As the tar was made at the gas-works, it was run into a large tank. After standing for some time, the liquor rose to the top, and by means of a pump the tar was got out; and the only question for the Court was whether at one stage of the delivery the defendants got a little too much water. A sample order was given for 100 barrels; and the defendants, being satisfied with the quality, afterwards ordered 1500 barrels. In June there were complaints. It was said that the tar was too thin for the purpose for which it was purchased—viz., the manufacture of tar paving; but the plaintiffs denied that they knew what the tar was wanted for. Had it been allowed to stand in the tank at the defendants' works, the water could have been drawn off. From analyses made by the defendants, the average percentage of water appeared to be 18; and as this was 12 per cent. above the normal quantity, the plaintiffs were willing to allow a rebate of £8 5s.

Mr. *A. E. Broadberry*, the plaintiffs' Engineer and Manager, said that prior to January last year they had not had any dealings with the defendants. When the tar was ordered, he was not informed of the purpose for which it was wanted; and he assumed that it was for road sprinkling. The tar flowed into the tank after condensation from the gas, and in the process of condensation water was produced which took up ammonia; and the two flowed into a tank which would contain roughly about 100,000 gallons. In January, the tank would be nearly full. No tar was absolutely free from ammoniacal liquor. There was no usual standard; but there was a trade custom to allow for any water above 5 per cent. Tar was more fluid in the summer than in the winter. One analysis sent by the defendants showed 78·5 of water, which witness considered simply absurd.

Mr. *Joseph Fisher*, the Assistant Engineer and Manager of the plaintiff Company, Mr. *Warburton*, the Chemist, and Dr. *Harold G. Colman* having given evidence,

Mr. BAILHACHE, K.C. (with him Mr. NEILSON), for the defendants, said his case was that the tar contained such a large excess of water that it was absolutely useless for their purpose.

Evidence was given by several employees to the effect that the tar would not bind, and that before it could be used it had either to be mixed with good tar obtained from the Maidstone Gas-Works or with pitch.

His LORDSHIP said he was clearly of opinion that the contract was not one to sell tar fit for tar paving, or that the constitution of the tar was guaranteed. The tar, which was a residual product of the Gas Company, was sold as such, and no doubt might vary from time to time. There appeared to have been an excess of water in the tar sent to Maidstone; and in respect of this the defendants were entitled to a reduction of £15. There would be judgment for the plaintiffs on the claim for £59 19s. 5d., with costs; and for the defendants on the counterclaim for £15, without costs.

Johannesburg Gas Plant Contract Litigation.

In the First Division of the Court of Session at Edinburgh last week, the case was mentioned in which the Municipal Council of Johannesburg sue Messrs. D. Y. Stewart and Co. (1902), Limited, of Glasgow, for repayment of £143,095 of the purchase price already paid, and also for payment of £275,000 as damages, in connection with the fitting up of an installation of electrical plant and gas-engines at Johannesburg.* The House of Lords have ordered that a proof in the whole case be taken in Scotland, instead of an arbitration in England and Johannesburg, as was asked for by the defenders. The motion before the Court had reference to the recovery of documents by a Commissioner, who is taking evidence in South Africa. These were partly allowed and partly disallowed. The proof was fixed to begin in Edinburgh on June 6; and a fortnight has been allowed for it.

* See "JOURNAL," Vol. CV., pp. 322, 864.

North Sussex Gas and Water Company.

In the Chancery Division of the High Court of Justice last Saturday week, Mr. Justice Swinfen Eady had before him the case of *Lomax v. North Sussex Gas and Water Company*. It was an action by a debenture-holder which came on as a short cause in default of appearance and defence. Mr. P. Hastings, representing the plaintiff, said the Company was incorporated in 1905 by an Act under which power was given them to borrow on mortgage to the extent of £4000. By a second Act, obtained in 1906, the power was extended, and the limit of borrowing was fixed at £8000. Under these powers, the Company had borrowed £5100 on debentures, all ranking *pari passu*, but some bearing interest at 5 per cent. and some at 4½. The plaintiff was the holder of ten debentures to the amount of £1000; and there was default in the payment of interest on June 24 last. The security was in jeopardy—there being unsatisfied judgments against the company and executions levied; and on July 22 last a Receiver was appointed, and still remained in possession. Counsel asked for a declaration that the debenture-holders were entitled to a charge on the undertaking and on all future calls, and for a continuance of the Receiver. His Lordship, having looked at the Act, said there did not appear to be any power to borrow on the security of uncalled capital. Mr. Hastings said this was endorsed on the debentures. After a short discussion, the matter stood over for a week, for Counsel to see if he could find any authority for a charge on uncalled capital. This he produced last Saturday; and his Lordship said he was satisfied. He gave judgment for the plaintiff.

Sir C. Herne-Soame's Financial Difficulties.

At the Shrewsbury Bankruptcy Court, last Tuesday, Sir Charles Buckworth Herne-Soame, of Dawley, Shropshire, whose name will be remembered in connection with the promotion of certain companies of the Eaton group, came up for public examination. The summary statement of affairs disclosed gross liabilities amounting to £176; and the assets were stated to consist of £100 shares in companies, and law and other books of the value of £7 10s. The alleged causes of failure were household and personal expenses exceeding income. According to the observations of the Official Receiver, the debtor was admitted as a solicitor in 1889, and commenced practice. His income, however, was small and fluctuating, and proved insufficient to meet his expenses; and in 1897, with the assistance of friends, who contributed £200 for the purpose, he paid a composition of 7s. 6d. in the pound to his creditors. He was adjudicated a bankrupt in 1897; but no assets were realized, and he afterwards relied chiefly on his friends for his maintenance. On the death of his father, Sir C. B. H. Soame, in 1906, he succeeded to the title; but no estate passed with it. Under his father's will, however, an annuity of £104 was left to him, determinable upon bankruptcy, or upon any attempt to charge or mortgage it. In addition, the will empowered the Trustees to pay such a sum as would enable him to apply for his discharge under the then existing bankruptcy; and an order was granted on July 10, 1907, on payment of a dividend of 10s. in the pound. Thereafter, having ceased to take out his solicitor's certificate, he depended upon the annuity, coupled with a small and uncertain income derived from fees as Director of four Companies in which he held qualifying shares. The estimated value of these shares and the law and other books were the only assets disclosed; and the shares must be treated as of "very uncertain marketable value." In reply to the Official Receiver, debtor said the annuity had been for some time past his chief means of subsistence; but he had certain qualifying shares in different Companies, all emanating from the same source. Though none had arrived at a dividend-paying stage, as a Director of them he had been receiving fees. When asked if his connection with the Companies referred to had been sought and brought about solely with a view to utilizing his title on the prospectuses, he said possibly it had to a certain extent; but now it was solely because he knew something of the law affecting companies. If he were to be adjudicated bankrupt, his annuity would go altogether; and, in view of this, he was taking steps to make some arrangements with his creditors, whereby the bankruptcy proceedings would be annulled, and they would be offered a composition of 7s. 6d. in the pound. The proceedings were adjourned to allow the debtor to make an offer.

REGISTER OF PATENTS.

Lighting Gas-Lamps.

STILL AND SONS and ADAMSON, A. G., of Hatton Garden, E.C.

No. 3203; Feb. 9, 1910.

This invention has particular reference to the lighting of the gas-lamps of railway carriages, so as to obviate the use of pilot lights and lighting by hand.

The gas may be ignited by a sparking device connected to the secondary circuit of an induction coil, the primary circuit of which is caused to be completed by the ordinary gas pressure in the gas-passage to the burner due to the turning on of the gas; or may be caused by the heating of a resistance wire in the circuit completed by the gas pressure. After ignition has been effected, the circuit is broken by a thermostatic circuit breaker, which is heated by the burning gas, but which, upon cooling, again completes the circuit and re-ignites the flame if the gas is still turned on. To enable the guard of a train to turn the gas on or off, in addition to the ordinary hand-controlled gas-cock there is provided a supplementary gas-valve adapted to be opened or closed by the movement of the armature of the electro-magnet, the circuit of which is provided with a push-button under the control of the guard.

Gas-Meters.

HANSFORD, J., of New Barnet, and WRIGHT, A. C., of Witton.

No. 3490; Feb. 12, 1910.

The primary object of this invention is to provide a meter adapted to be used for petrol or other gases liable to attack the materials usually employed in the construction of meters; the meter being so designed as to enable the parts with which the gas comes in contact (with the exception of the flexible diaphragm) to be made of cast or stamped iron, without the use of any soldered joints. The flexible diaphragm (if of leather) is so treated as to withstand the deteriorating action of the gas, or else a diaphragm suitable for the purpose may be formed by lapping fine steel wire with asbestos and weaving it into a fabric and subsequently rendering the fabric impervious to the gas by soaking it in indiarubber solution or equivalent material.

Steam Generation by Gas.

BONE, W. A., of Leeds University, WILSON, J. W., of Armley, Leeds, and M'COURT, C.D., of Balham Hill, London, S.W.

No. 4362; Feb. 22, 1910.

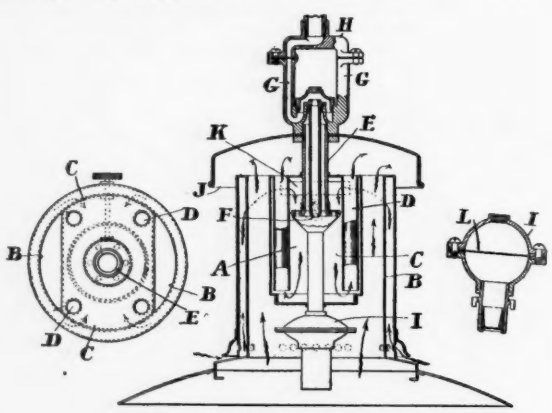
This invention is dealt with on p. 834.

Gas-Lamps.

BROWN, T. W., of Harringay, and TILLEY, F. C., of Kingsland Road, N.E.

No. 4439; Feb. 22, 1910.

The object of the inventors is to reduce the drag on the gas caused through sucking in air—"thereby ensuring a better and more complete mixing, and consequently better combustion at the burner; also effecting a better heating of the mixture of gas and air at the burner, and at the same time preventing the lamp proper from becoming too much heated by the uprising products of combustion."



Brown and Tilley's Gas-Lamp.

The lamp body is a double cylinder forming a ring chamber open at the bottom to the atmosphere, and at the upper part to a chamber A within the cylinder B. The chamber A is not of the same capacity as the space within the inner cylinder, but is constructed to form passages between the inside cylinder B and the inner cylinder C for the passage of the products of combustion from the burner below. From the top of the chamber A are pipes D, open top and bottom; the bottom ends being near the bottom of the inside chamber A, and centrally through the top of it is passed a tube E, to which are connected the hood, socket, and other appliances for carrying the lamp from the gas-pipe above. The gas-nipple F forms part of, or is carried by, a pipe within the tube E, and has at its upper end a cap screwed to a socket provided with arms G, one or both of which may be a tube communicating with the gas-pipe through a head-piece H.

When the burner is lighted, the products of combustion act against the deflector or against the projecting edges of the heating-chamber I, and pass upwards through the inner cylinder and away to the outlet J, imparting its heat to the walls of the two chambers. The gas passes from the nipple into the mixing-tube, and the air passes in at the bottom of the cylinders and thence into the inside chamber A at K, where some of it is taken by the gas into the mixing-tube, while some of the air is taken up the pipes D in the inside chamber A, due to a suction or draw created by the products of combustion; this suction or draw also assisting in creating a downward motion of the air in the inside chamber, "which materially assists in preventing the drag on the gas," and, by reason of the mouth of the mixing-pipe being cone-shaped (assisted by the downward movement of the air), a full supply of air is always presented to the column of gas—the air freely follows the gas and ensures a better mixing in the mixing-tube.

The mixture of gas and air enters the heating-chamber, and, after passing the gauze L, "gets more highly heated, and is, in consequence, more efficient at the burner; so that a less pressure of gas is required than is now the case to produce an intense light."

Treatment of Fuel.

ELY, B., of Pye Bridge, and ROLLASON, A., of Nottingham.

No. 6759; March 17, 1910.

It is well known, the patentees remark, that in the manufacture of coke in retorts or gas-ovens "the carbon in the coal when heated becomes changed in its physical properties and becomes a good conductor of heat; and if the hot carbon on leaving the retort is allowed to be in contact with air or any substance which absorbs heat quickly, or if the hot carbon be cooled with water, it retains the properties of conducting heat, and therefore becomes difficult to ignite or burn without a good draught. If, on the other hand, the hot carbon on leaving the retort is allowed to cool slowly, by preventing the rapid conduction of heat to the air or other materials, the carbon particles become changed and return to their normal state. The fuel produced by this method of slow cooling will ignite readily and burn in a similar manner to the original coal before carbonization.

For the purpose of producing smokeless fuel, suitable for domestic use or other purposes, the coal can, they continue, either be fully carbonized or partially carbonized as may be required. If only a partial carbonization is required, then the operations are conducted at a low temperature; if, on the other hand, it is required to take out all the gases possible and fully carbonize the coal, the operations are conducted at a high temperature.

Their present invention relates to apparatus consisting of a cooling chamber or receptacle for receiving the hot carbon, the walls, bottom, roof, and doors of which are constructed hollow of perforated plates of iron and steel or of fire-bricks or other refractory non-conducting material. The hollow spaces or cellular chambers between the inner and outer plates of the walls, bottom, roof, and doors are filled with coke breeze, broken fire-brick, or other non-conducting substance. By this arrangement, "air is prevented from getting into contact with the carbon in sufficient quantities to consume the same, and the heat from the carbon is taken up slowly and dissipated. Sufficient air, however, is allowed to come in contact with the fuel to volatilize the sulphur and other compounds contained in it."

Incandescent Gas-Mantles.

STILL AND SONS and ADAMSON, A. G., of Hatton Garden, E.C.

No. 11,150; May 5, 1910.

To provide mantles capable of withstanding a large amount of vibration as compared with mantles made by the ordinary known methods, and to render the production of durable mantles less dependent on the uniformity of the results of the various processes in their manufacture than has been heretofore usual, the patentees propose to attach a mantle to its support by applying a thin layer of uniting medium to the outer surface of the support, which is dried, and the mantle (also dry) is then embedded in, or combined with, the uniting medium by fusing the uniting medium—during the incineration or hardening of the mantle—and allowing it to set with only the inner surface of the mantle fabric embedded therein or combined therewith; the outer surface of the fabric remaining free. The uniting medium is composed of silica, soda, and alumina; and the materials are so proportioned and diluted that, on fusion, it does not tend to run, as this might cause irregular hardening, and consequent brittleness of the heads or necks of the mantles, as does the addition to those parts of mantles in contact with their supports of hardening fluids and the like which soak into the fabric. As an example, the uniting medium may be composed of silicate of soda (concentrated solution) 25 per cent., alumina 25 per cent., and water 50 per cent.

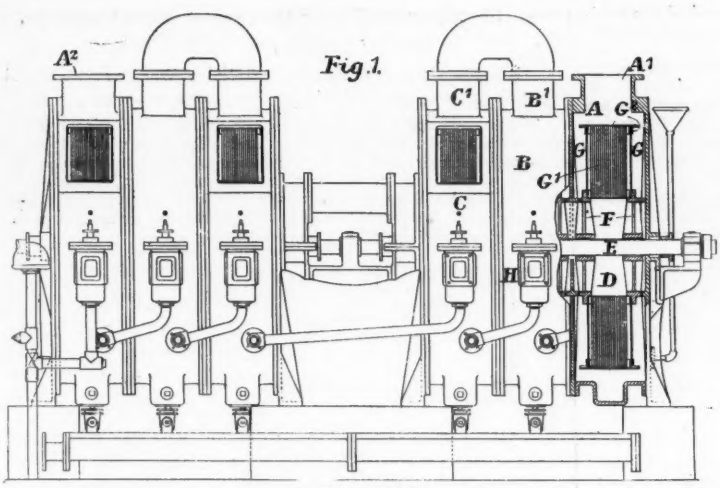
Purification of Gas.

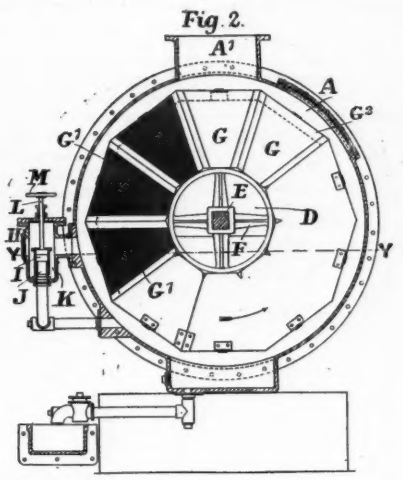
SADLER, H. S., and ASHMORE, BENSON, PEASE, AND CO, LIMITED, of Stockton-on-Tees.

No. 4613; Feb. 24, 1910. No. 19,382; Aug. 18, 1910.

This combined invention relates to mechanical rotary washer-scrubbers used in the extraction of impurities from illuminating gas; it consists partly in the adaptation of canvas screens as a scrubbing material to rotary drums in substitution of bundles hitherto used for this purpose, and partly in arranging such screens so as to cause the gas to penetrate the perforations of the several screens instead of only passing over them.

Fig. 1 (p. 855) is a side elevation and part section of the apparatus when formed in two main divisions, preferably circular in shape and of a size proportionate to the quantity of gas to be treated. Each main division consists of three compartments or chambers A, B, C, divided by partition-plates but communicating with each other in series. In each compartment is mounted on the driving shaft E a drum D, in the form of cylindrical inner frames F supporting the side plates G and screens G^1 of the outer frames G^2. Fig. 2 is a transverse sectional view of fig. 1 showing a series of bundles of screens G^1 fitted into the





Sadler and Ashmore, Benson, Pease, and Co.'s Washer-Scrubber.

outer frames G^2. Y is the liquor line within the compartment, the level of which is adjusted by the controller H.

The inlet and outlet for the gas are provided on the end compartments, and the gas is admitted either from the top of the end chamber or by an inlet box on the end plate, and is similarly discharged from the other end chamber of the apparatus. Assuming therefore the gas to enter the compartment A at A^1, the gas passes between the screens of the drum D into the next compartment B through the inner frames F, and again between the screens into the bend B^1 C^1, and so on into the next compartment C, from which it passes to the left-hand division of the apparatus, and is eventually discharged by the outlet A^2. But while the gas is thus effecting this sinuous passage through the drums of the apparatus, they are rotating, and the screens are being alternately driven edgewise through the liquor and then through the gas.

In all respects both the apparatus and process follow the usual method of treatment; but instead of using bundles of iron or steel plates, or of wood, whether punctured or otherwise, the patentees substitute screens of canvas by which they claim to effect these several improvements: (1) Owing to its nature canvas does not easily corrode or rot, and, therefore, does not require frequent replacement like plates of iron or steel, which are quickly affected by ammonia. (2) Low cost of material, and consequently small outlay when replacement of scrubbing material becomes necessary. (3) Owing to the greater absorbing capacity of liquor by canvas, screens of this material can be pitched further apart; thus facilitating the passage of the gas and thereby reducing the possibility of back-pressure to a minimum. The free passages between the screens also prevent (or materially remedy) the tendency to tarring-up; thus enabling the capacity of the washing and scrubbing compartments to be more completely utilized.

The device for adjusting and controlling the depth of the washing liquor consists of fitting a screwed socket I on to the overflow pipe J within a water-pocket K projected from the casing of the compartment; the socket being adapted for adjustment to the level or depth required by means of the spindle L and hand-wheel M, which spindle is secured to the open socket. Each compartment has its washing liquor controller, the outflow of which is passed on from one compartment to the next until run off for collection at the end of the apparatus. The arrangement follows the usual practice in these respects, except that the level of the liquor may be equal in all the compartments, or may be reduced in each successive compartment as desired; and it is to be distinguished in this respect from means for merely regulating the flow from one compartment to another without adjustment as to depth as may be required from time to time.

Automatically Lighting and Extinguishing Gas-Burners.

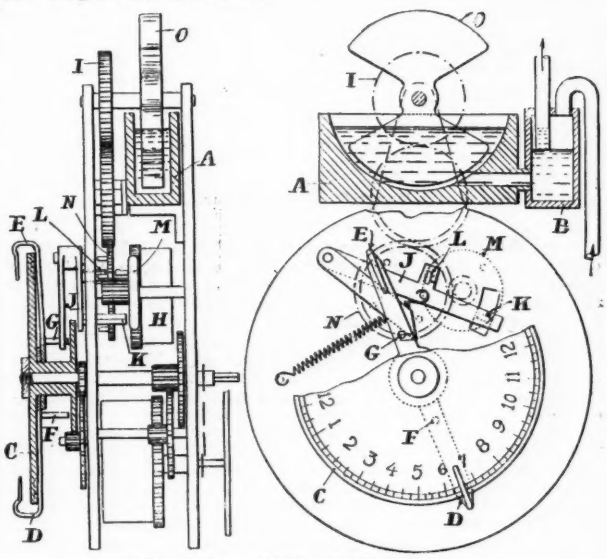
Compagnie pour la Fabrication des Compteurs et Materiel d'Usines a Gaz, of Paris.

No. 11,722; May 11, 1910. Date claimed under International Convention, May 13, 1909.

This invention relates to a device for automatically lighting and extinguishing gas-burners, comprising a closing device with a hydraulic seal, operated by clockwork mechanism; the variations of the seal being brought about periodically by a trigger mechanism controlling the action of a driving device which is independent of that actuating the clockwork mechanism which releases the trigger mechanism.

In the construction shown, changes in the level of a liquid in adjacent chambers A B at given hours can be produced suddenly; and, consequently, instantaneous lighting and extinguishing of the burner can be obtained. The 24-hour wheel C acts at given periods on parts of a clutch controlled by a spring-barrel which, on suddenly unwinding, brings about the working of the closing device with the hydraulic seal. In order to carry out these operations, the disc, controlled by clockwork, drives two hands D E, which can be set respectively opposite the divisions of the disc corresponding to the hours of lighting and extinguishing. The arms of the two hands carry tappets F G, acting successively at each rotation of the disc in order to bring about the release unlocking the wheels which are operated by a spring-barrel H, and enabling the wheel I, controlled by the wheels, to be moved to the extent of a quarter-of-a-revolution. To this end, the arm J of a double lever carries two tappets, one of which, K, when the lever is raised, comes into the path of a pin on a fly-wheel M operated by the spring-barrel H. The other tappet L, when the lever is lowered, comes into the path of four pins arranged at an angle of 90° on a wheel N engaging with a pinion of the fly-wheel. In the normal position, one of the pins of the wheel is in contact with the tappet L of the lever J.

The operation of the device is as follows: During the rotation of the disc C, one of the two tappets F G, secured to the hands D E, strikes the arm of the double lever and raises the latter. Owing to this movement, one of the pins of the wheel N is disengaged from the tappet L, so that the wheel, being driven by the barrel H, rotates to a fraction of a quarter-of-a-revolution, while the fly-wheel M also rotates, and brings its pin in contact with the tappet K of the arm J, which stops the rotation of the wheel I, which has made only about one-tenth of a revolution during all those movements.



A French Lamp Lighter and Extinguisher.

The disc continuing to rotate, the tappet which holds the arm raised releases the latter; so that, under the action of the spring, it returns to its original position. The pin of the fly-wheel is then disengaged from the tappet K, and the next pin of the wheel N comes into contact with the tappet of the same arm, which keeps the wheels stationary. The movement which is given to the wheel I is calculated so that, owing to the previous action of release by the double lever, the wheel rotates exactly to the extent of a quarter-of-a-revolution.

To the spindle of the wheel I is keyed a disc O, having two solid sectors and two recessed sectors. The disc is arranged in a tank A containing water, oil, or mercury. The tank A is in communication with another tank B, into which open the gas inlet and outlet pipes, the orifices of which are at different levels. When one of the solid sectors of the disc plunges into the liquid, the level of the latter rises in the tank B and closes the orifices of the gas outlet pipe, so that the burner is extinguished. When, on the contrary, the solid sectors of the disc emerge from the liquid, the level of the latter sinks in the tank B below the orifice of the gas outlet. The gas then passes to the burner, where it is ignited by the bye-pass.

The variations of the lighting and extinguishing movements are effected by means of the hands D E, set relatively to the disc C, indicating the hours, as explained.

Gas Purifying Apparatus.

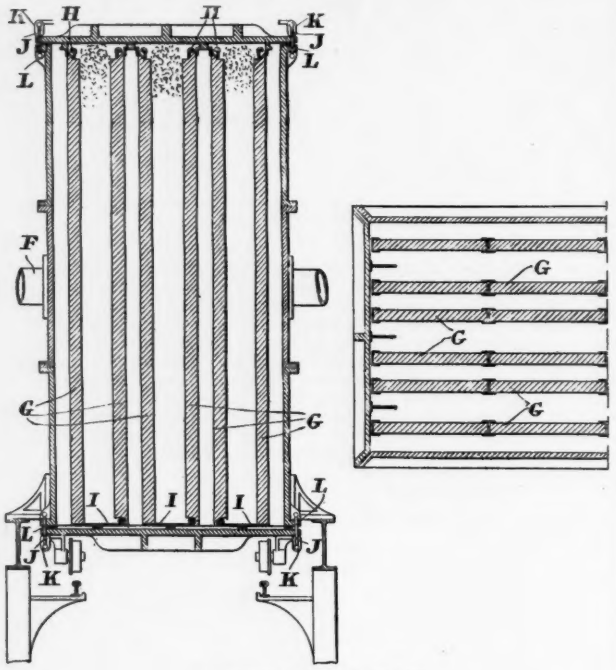
Masters, J. R., of Harlesden.

No. 17,281; July 20, 1910.

This invention has for its chief feature of novelty the vertical suspension of the grids through which the gas passes and between which the lime or other purifying agent is enclosed in such manner that the grids

may be shaken or separated so as to facilitate the removal of the purifying agent for replacement or other purpose, or the grids themselves removed for repair or replacement.

As shown, the gas inlet E is in one of the side walls, and is preferably (but not necessarily) centrally disposed therein. The gas outlet F is in the opposite wall. The grids G, which are of any usual construction, are suspended upon rods H extending longitudinally at the top of the casing parallel to the side walls, and may be arranged in pairs (as shown), or else singly, and all the intermediate spaces filled with purifying material. In this latter case, there is necessarily (as in the construction shown there is preferably) a free space left between one or both of the end grids and the adjoining side wall, to enable the gas to distribute itself over the whole area of the grids, and the latter to be separated for the removal of the spent lime.



Masters' Vertical Purifier.

Each of the spaces between the grids which is filled with lime is closed by a hinged door I, having a latching device, and below this again is the removable floor. This floor is clamped to form a gas-tight joint with the walls and ends of the casing by hinged straps J and eccentric clamps K; the gas-tight joint being effected by a lute of india-rubber strips L. The floor may (as shown) be provided with wheels or runners; so that when it is unclamped and allowed to drop, the runners rest upon rails and the floor removed from below the casing. The hinged doors may then be unlatched, and the consolidated purifying agent allowed to drop clear of the floor.

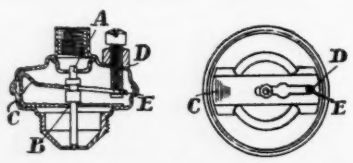
To ensure the passage of the whole of the gas through the purifying medium, the space between the ends of the grids and the cover and floor of the casing is sealed by india-rubber lutes, and, further, baffles are provided projecting from the end plates a sufficient distance between the individual grids of each pair to ensure that the resistance to the flow of the gas around the ends of the grids will be considerably greater than the resistance to its flow through the grids and the purifying agent.

Regulating Nozzles for Bunsen Burners.

LANGE, K., and MENGERS, O., of Berlin.

No. 26,673; Nov. 16, 1910.

This invention relates to nozzles for incandescent light burners, in which the size of the gas admission aperture is regulated by a needle valve contained inside the casing of the nozzle in the direction of its axis.



Lange and Mengers' Burner Regulator.

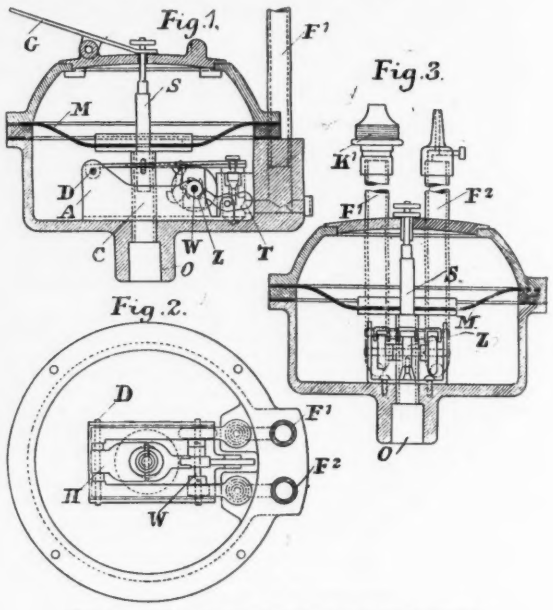
The valve is shown mounted in two bearings A and B. Between them is a spring C, which, when adjusted, does not exert any lateral pressure upon the valve; "so that an absolute central motion of the latter in the direction of the axis of the nozzle is effected." The spring, formed U-shape, is connected to the screw D, having a recess at E in a similar way as to the needle valve. It is compelled, therefore, to move up and down with the screw, when the latter is adjusted. The spring may also be connected to the screw in such a way that the latter moves the needle valve only in one direction; while the movement in the other direction is effected by the tension of the spring previously compressed.

Lighting and Extinguishing Street Lamps.

WIRTZ, J., and HINNE, F., of Dortmund.

No. 18,000; July 28, 1910. Date claimed under International Convention Aug. 5, 1909.

This arrangement is essentially characterized by the fact that the gas supply pipes for the illuminating and pilot flames are of the same internal diameter, and the burner-heads are interchangeable; so that the function of the lamp can be changed merely by interchanging the burner-heads and by adjusting the ratchet mechanism from the exterior, so as to cause it to rotate to an extent corresponding to two positions, and so convert a night lamp into an evening lamp.



Wirtz and Hinne's Lamp Lighter and Extinguisher.

Figs. 1 and 3 are vertical sections (taken at right angles to each other) of the casing containing the membrane and the ratchet gear; while fig. 2 is a plan.

The casing is in two parts; the lower part containing the ratchet-gear, and the upper part the membrane operated by the gas pressure. Through the opening O the gas is supplied to the pipes F^1 F^2 through valves. The parts for transmitting the movement of the membrane to the ratchet-gear, and the ratchet-gear itself, are of known construction. A spindle S is connected with the membrane M; its cross pin alternately lifting and depressing the operating lever H rotatably mounted in the frame A (fig. 2). A pawl mounted on the lever transmits the movement to the ratchet-wheel Z and its shaft W. The cross pin of the spindle S slides in a slot in the guide-tube C in such a manner that the stroke of the pin is limited by the slot, so that each stroke corresponds to a rotation of the operating shaft to the extent of one tooth of the ratchet-wheel Z. The ratchet shaft W is prevented from retractive rotation by means of a locking pawl T mounted in the casing. On each side of the ratchet-wheel the shaft W carries a plate formed as a double cam, and acting upon single arm levers rotatable about the bolt D, and which serve to lift and depress the valves. The cam plates are of such different construction, and are so staggered on the shaft W, that one valve is opened before the other is closed; so that the extinction of both flames is impossible. The supply pipes F^1 F^2 are of similar size and internal diameter. The differently constructed burner-heads K^1 K^2, the former of which serves for the illuminating flame and the latter for the kindling flame, are removably mounted on the supply pipes, and formed in such a way that they fit both pipes.

On the upper part of the casing, a lever G is arranged externally; so that the membrane M can be lifted by hand and, consequently, the ratchet-wheel Z adjusted by one tooth on each operation of the lever.

The method of operating the apparatus is shown by a diagrammatic illustration in the specification; and by interchanging the burner-heads on the supply pipes and adjusting the ratchet-gear from the outside, the apparatus can be used at will for night or for evening lamps.

Droitwich Gas-Works Extensions.—At a Local Government Board inquiry held at Droitwich with reference to an application by the Town Council to borrow £2000 for gas-works purposes, the Gas Manager (Mr. F. Shewring) said the primary object of the Council was to erect a new gasholder, general stores, and coke-store. They had three beds of retorts; these and other extensions having been paid for out of revenue. In 1887, they had two gasholders, with a capacity of 78,000 feet; but this was now reduced to 68,000 feet, as one of them could only be partly used. In that year, there was a consumption of between 8 and 9 million cubic feet, and there had been a large increase since. Mr. Wright, who opposed the application, contended that any necessary outlay in the directions referred to should be met out of revenue. He remarked that during thirty years the borough had never received a penny out of the gas undertaking. The Council showed in their balance-sheet that they had £1167 in the bank; and assuming that they had the same prosperity next year, they should have £2000, and therefore be in a position to pay for any extensions. It should be borne in mind that the sum involved need not be paid all at once.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bill read a second time and committed: Swansea Gas Bill.

Bills reported, with amendments: Luton Water Bill, Slough Urban District Water Bill.

The opposition to the Ely Rural District Water Bill and the Oystermouth Urban District Council Bill has been withdrawn.

Metropolitan Water Board (New Works) Bill.

On Monday last week, Lord Balfour of Burleigh moved to refer the above-named Bill to a Joint Committee of both Houses of Parliament. He said the inquiry would be long and costly, and he submitted the motion for the saving of expense and time, as well as for other reasons. The Thames Conservancy Bill should be referred to the same Committee; but that Bill originated in the other House, where he had reason to believe a motion to refer it to the proposed Joint Committee would be agreed to. There were 64 petitions against the Bill; and several of the petitioners raised the question of injury to the scenery of the Thames, which was the central point of an addition to the motion of which Lord Eversley had given notice. Lord Eversley then moved, as an amendment, to add to the motion the words "and that the Committee be empowered to consider the proposals of the Bill in relation to the public interests, as well as to the various interests directly affected, and to inquire and report whether any of the works proposed will seriously interfere with the scenery of the River Thames and with the interests of the public using the river as a pleasure ground, and what safeguards are necessary for the protection of such interests." His Lordship said it appeared to him that the public interests in the preservation of the river had been disregarded by the promoters of the Bill. Lord Balfour said there was, no doubt, a great deal to be said against the proposals contained in the Bill, and there was a case for inquiry. There was a strong presumption that those engaged in the duty of providing London with water were more concerned to get a supply cheaply than to preserve the amenities of the Thames; but there was no risk of the danger which Lord Eversley presupposed. Earl Beauchamp said they all wished to maintain the amenities of the river; but, in view of what had been said by the Lord Chairman of Committees, he thought there was no doubt that ample opportunity would be given for public interests to be represented, and for the points urged on their behalf to be considered. In the circumstances, he suggested that Lord Eversley would find himself in accord with the feeling of the majority of their lordships if he accepted the assurance of the Lord Chairman. The amendment was by leave withdrawn, and the motion to refer the Bill to a Joint Committee was agreed to. It was ordered that a message should be sent to the House of Commons to communicate the resolution to them and desire their concurrence.

HOUSE OF COMMONS.

The following further progress has been made with Bills;—

Bills read a second time and committed: Halifax Corporation Bill, Weston-super-Mare Gas Bill.

Bill reported, with amendments: Tamworth Gas Bill.

Bill read the third time and passed: Felixstowe and Walton Water Bill.

The Gaslight and Coke Company's Bill will be considered by the Unopposed Bills Committee on Thursday.

The Chesterfield Gas and Water Board Bill has been referred to a Select Committee, consisting of Sir Henry Kimber (Chairman), Mr. Adkins, Mr. Rendall, and Mr. Sutton; to meet next Thursday.

Metropolitan Water Board (New Works) Bill.

Last Friday, the message from the Lords to the effect that the above-named Bill should be referred to a Joint Committee of both Houses was considered, and the resolution passed by the Upper House agreed to. On the motion of the President of the Local Government Board, it was resolved to send a message to the Lords that it is expedient that the Thames Conservancy Bill should be referred to the same Committee, and desiring their concurrence.

TAMWORTH GAS BILL.

House of Commons Committee.—Tuesday, March 14.

(*Before Sir* H. SAMUEL, *Chairman, Sir* G. W. AGNEW, *Mr.* D. BOYLE, *and Mr.* GOLDSTONE.)

This is a Bill promoted by the Tamworth Gaslight and Coke Company with the object of enlarging their limits of supply, extending their works and lands, obtaining additional capital powers, and providing for the supply of gas in bulk.

Mr. C. C. HUTCHINSON appeared for the promoters; while Mr. DISTURNAL represented the Staffordshire and Warwickshire County Councils—the only petitioners in opposition.

Mr. HUTCHINSON, in opening, stated that the Company commenced to work under a deed of settlement in 1835, and were incorporated by Act of Parliament in 1872. The Act authorized a capital of £9600, *plus* a further sum of £18,840. The maximum price within a certain area was fixed at 5s. 6d. per 1000 cubic feet, with a discount of 5 per cent., and outside this area at 6s. 6d. Under the present Bill, the maximum inside price was to be 5s., with power to charge a differential price outside. The £9600 authorized by the Act of 1872 was represented by £7340 of capital, and the £18,840 by £14,020 of capital. The Company had had a very successful career. The sale of gas, which was slightly under 10 million cubic feet in 1877, was no less than 44 millions in 1910. By the present Bill, it was proposed to extend the area of supply by including the two parishes of Shuttington and Polesworth, in the County of Warwick. It was calculated that in the present year the population of the existing area would be 16,450, and of the area proposed to be added 6350. In the two parishes there was no supply of gas or other illuminant of the sort. The proposed extension of the Company's operations had, in consequence, been enthusiastically welcomed by the local authorities concerned; while 600 firms or persons had undertaken to become customers of the Company. During the last 13 years, £23,000 had been spent by the Company; and it was estimated that in the next 12 or 14 years about £30,000 of further capital would be required. The Corporation and other local authorities concerned supported the Bill. A favourable opportunity having occurred, certain lands contiguous to the works had been acquired; and power was sought to regularize the transaction. The two petitions against the Bill were identical; and they were confined practically to an attempt to obtain, in respect of main roads and bridges affected by the measure, protection beyond that which was afforded by the general law, and which, in contested cases, Parliament, at all events for a number of years, had said was sufficient. Provisions beyond the general law for the protection of local authorities might be found in some Acts; but they had always been inserted by agreement to carry out a special bargain or to meet a special consideration, or else they had been inserted after a contest in order to deal with peculiar circumstances which the general law did not meet. The promoters held that there was no necessity for the suggested protective provisions, as they had worked for three-quarters of a century under the general law without difficulty occurring.

Mr. *John Hill*, a Director of the promoting Company, stated that the sale of gas had increased steadily, and that the Company had paid full dividends. Much development was possible in the present area of the Company in the provision of slot meters, stoves, and heating and cooking appliances. The Councils of both the parishes which it was proposed to supply had passed resolutions welcoming the Company. Power was sought to raise £15,000 further share capital, with the usual borrowing powers as to one-third more. This sum would not be excessive for their requirements in the next ten or twelve years.

Mr. *W. A. Sapey*, the General Manager, Engineer, and Secretary of the Company, stated that the Company had expended about £23,000. He put in an estimate of the capital required between 1911 and 1926. The total amounted to £29,596, and included high-pressure plant and mains for the new area, 700 slot installations, retort-bench extensions, new gasholders, and the enlargement of purifiers and mains. So that, even having regard to the capital authorized but unexpended, the proposed new capital of £20,000 was absolutely necessary. The two new parishes afforded a large and growing field for the operations of the Company. Already he had obtained 600 definite promises to take supplies of gas.

By the COMMITTEE: The present price of gas in both the inner and outer areas was 3s. 3d. per 1000 cubic feet. The Company wished, however, to be able to exercise the power to charge differentially in respect of Polesworth. They had issued a circular offering to supply gas at this place (which involved conveying the gas five miles) at 4s. 6d. per 1000 cubic feet—this figure to include certain items, such as cooking stoves, and slot meters. A parish meeting was thereupon held, and the offer contained in the circular accepted.

Mr. HUTCHINSON: I ask you, Mr. Chairman, to say the preamble the Bill is proved.

The CHAIRMAN: Very well.

Mr. DISTURNAL said the County Councils of Warwickshire and Staffordshire did not want to impede the work of a public undertaking such as that of the Company; but they wished protection with respect to their main roads and bridges, on which the gas-mains of the Company were to be laid. In the County of Stafford, there were 11½ miles of main road and 11 bridges which would be traversed by these mains. There were also 2½ miles of main road in the borough of Tamworth for the upkeep of which the County Council were responsible. In the proposed new area of the Company in Warwickshire, there were 3 miles of main road. At present, the only protection given to road authorities was contained in the Gas-Works Clauses Act of 1847. This protection practically amounted to nothing. The importance of main roads had increased, and was increasing; and the cost of upkeep was a very heavy burden. Parliament had interfered again and again to protect road authorities in the case of tramways, water-works, and gas-works; and he urged that the Committee should insert a series of clauses which his clients had prepared for their protection.

Mr. HUTCHINSON said there were a variety of new clauses proposed by the two County Councils. Although he did not abandon his contention that nothing beyond the general law was required, he thought that some of the proposed clauses would illuminate the General Act; and he was prepared therefore to assent to some. He would accept the first four.

The first clause provided that all mains, pipes, and works to be laid in any main road should be laid in such position as the Surveyor to the County Council reasonably directed. The second proposed that the notice required with respect to breaking-up streets should, as regarded any main road, or county or main road bridge, be not less than seven instead of three clear days. The third related to the scales of the plan required by section 9 of the Gas-Works Clauses Act, 1847, as regarded any county or main road bridge, to sections showing clearly the proposed works, and to the periods of notice for particular works. The fourth directed that nothing in the Act should authorize the Company to interfere with the structural part of any county or main road bridge without the consent in writing of the Surveyor to the County Council, such consent not to be unreasonably withheld.

Mr. DISTURNAL said the next clause was as follows:

(5) Nothing in this Act shall interfere with the right of the County Council to alter the level of, or deviate, drain, widen, reconstruct, or improve in any manner they think fit, any main road in or along which any mains, pipes, or works of the Company shall have been laid, and the Company shall, with all convenient speed on receiving notice in writing under the hand of the

Clerk or Surveyor to the County Council so to do, alter the position of any such mains, pipes, or works in the manner and to the extent prescribed by such notice, or as, in case of difference, shall be determined by arbitration in the manner hereinafter prescribed, and the County Council shall not make any compensation to the Company for any expense or loss to which the Company may be put in consequence of any such alteration, deviation, improvement, or other work of the County Council, provided that during alteration, deviation, draining, widening, reconstruction, or improvement of such main road the County Council shall, at the cost of the Company, afford all reasonable facilities for temporarily carrying such mains, pipes, or works along the main road so as not to interrupt the continual supply of gas or to diminish the pressure of such supply through such mains or pipes.

Mr. HUTCHINSON intimated that if the clause were altered so that the Council should make compensation to the Company for any expense or loss to which the Company might be put, he would accept it.

Mr. DISTURNAL said the point of the matter was that County Councils would not alter roads unless it was necessary in the interests of the public. If it was right, in the public interest, to alter a road, the County Council ought to be able to do the work unhampered. Without the provision, great expense might be incurred if a county bridge carrying a main required alteration. The Company were carrying on business for their own profit; and if the Bill went through as it stood, whenever a county council desired to alter a road or bridge they would have to incur a great deal of additional cost in consequence of the existence of gas-mains on it. Parliament should not permit this to happen. A similar provision to that now sought was inserted in a Tramway Order in 1908.

The CHAIRMAN asked Counsel to refer him to a case in which a similar clause had, on petition, been put into a Gas Bill.

Mr. DISTURNAL said he was told that in the Worcestershire Electric Power Act a similar clause was inserted after a contest.

Mr. HUTCHINSON said there were numbers of instances in the last three years in which similar clauses were rejected.

Mr. DISTURNAL said that no doubt in most instances the clause had been inserted by agreement. But where was the difference in principle between the insertion of such a clause with reference to tramways and the insertion of such a clause with reference to gas undertakings? The chance of new road works interfering with a tramway was very much greater than the chance of their interfering with gas-mains. Yet Parliament had imposed the obligation such as that he now suggested on tramways. The next clause (No. 6) was similar to No. 5, except that it dealt with bridges.

Mr. HUTCHINSON would accept this clause also, if the County Councils undertook to pay the cost. He would accept the next clause, which provided that all works should be so executed by the Company as not to stop (so far as reasonably practicable), impede, or interfere with the traffic, the Company not to break up, at any one time, a greater length than 100 yards of any main road.

Clause 8 was as follows:

The Company shall pay to the County Council the reasonable costs which the County Council may incur in the repair and reinstatement of so much of any main road, or of the road over any county or main road bridge, or the approaches thereto, in which the mains, pipes, or other works of the Company are or may be laid, as may be damaged by reason of the traffic being concentrated thereon during the laying, alteration, and renewal, or repair of the said mains, pipes, or other works.

Mr. DISTURNAL explained that when mains were laid or repaired, traffic was concentrated on a particular line of road, doing an immense amount of damage, especially if the work lasted any considerable time. Under the general law, the promoters in such a case were only bound to repair the portion of road which they broke up, and were under no obligation to repair the part of the road which was destroyed by the concentration of the traffic. Surely this obligation ought to be imposed on the promoters. Clause 9 provided for the laying of pipes by the Company at a depth of not less than 2 ft. 6 in.; the depth, if the pipes were of steel instead of cast iron, to be not less than 2 feet. Clause 10 proposed that if the Company, in the execution of works, caused damage, injury, or disturbance to a road or bridge, and neglected or refused to make it good, the County Council, after 14 days' notice, might do all the work reasonably necessary to make good the damage, injury, or disturbance; the Company to repay to the County Council the cost.

Mr. HUTCHINSON said clause 10 was covered by section 12 of the Gas-Works Clauses Act.

Clause 11 was as follows:

The County Council shall not, except in the case of their negligence, be liable for, or in respect of, any damage or injury which may be caused to any mains, pipes, or other works belonging to the Company through the reasonable and proper use by the County Council of any steam or other roller, scarifier, or other similar appliance.

The last clause provided for arbitration in case of difference arising with respect to these clauses.

Mr. HUTCHINSON intimated that he would accept the last.

Evidence in support of the clauses was then taken.

Mr. *John Wilmot*, the County Surveyor and County Bridge Master of Warwickshire, stated that the traffic and the weight of the vehicles using the main roads were increasing. Improvements in the main roads would undoubtedly be required; and in some cases the surface of the road would have to be widened. He had experienced a good deal of difficulty in connection with the matters dealt with in clause 5. Altering the level of a road involved altering the level of gas and water pipes; and such work had involved the county in a good deal of expense. This expense might impede the carrying out of a proposed improvement. Improvements were not proposed until a district increased. If a district increased, it would bring increased profit to the Company; and it did not seem unfair, therefore, for the Company to pay some portion of the expense of the improvement. With regard to clause 8, if the roads were opened for the repair of mains the traffic was concentrated on one side, and the cost to the road authority was increased. Pipes, if of cast iron, should be laid at least 2 ft. 6 in. deep, and if of steel at least 2 feet deep. It was the modern practice to lay them at a depth of 2 ft. 6 in.

By the COMMITTEE: Breakages had occurred in the case of pipes laid at a depth of only 2 ft. It was, however, difficult to say what caused the breakage. It might be a steam-roller or a heavy engine. The roads had sometimes now to bear a weight of 30 or 40 tons. He could not say that breakages of pipes had been more frequent of recent years. Pipes had, however, been laid at a greater depth recently.

In further examination, witness said the Council had had several claims in respect of pipes broken by their steam-rollers. While the claims involved small sums, they caused considerable trouble.

Cross-examined: The Gas Company had always behaved reasonably; and there had been no complaint against them. It was fair to the shareholders that they should be saddled with the new burden which would be imposed by the proposed new clauses. A manufacturer whose goods were carried along a main road would benefit by an improved gradient; but he would simply use and not occupy the road as the Gas Company would. Questioned as to whether section 153 of the Public Health Act did not provide that the cost of altering the position of a gas-pipe was to be borne by the local authority, he said many things had happened since 1875, when the Act was passed.

The CHAIRMAN: Drastic alterations of the law come from downstairs in a Public Bill, not from a Committee.

Mr. HUTCHINSON remarked that protective clauses beyond the general law had not been inserted except by agreement or under special circumstances; and witness was understood to assent.

In the course of further cross-examination, Counsel contended that several of the matters raised in the clauses were covered by the existing law, and took exception to the provision with regard to the depths at which mains were to be laid, on the ground that if the Company wished to make a small alteration of an existing main the road authority would, if the clauses were sanctioned, be able to make them relay the whole main at the required depth.

Mr. GOLDSTONE inquired whether the maximum dividend had been paid by the Company in recent years.

Mr. HUTCHINSON replied in the affirmative.

Mr. *James Moncur*, the County Surveyor of Stafford, stated that some roads in his county would require improvement in the near future, and that difficulty had been experienced in the past owing to the non-existence of power with regard to water-mains such as the proposed clauses would give with reference to gas-mains.

Cross-examined: None of the proposed new area of the Company was in Staffordshire. The Company were well-behaved. He had never had any difficulty with regard to any of their mains.

The CHAIRMAN inquired the difference in cost between laying a main at a depth of 2 ft. and at a depth of 2 ft. 6 in.

Mr. *H. J. Clarson*, District Surveyor to the Tamworth Rural District Council, replied that, using cast-iron pipes in both cases, it would be about 6d. a yard, according to the nature of the ground.

Mr. DISTURNAL said he was told it would be about 3d.

The room was then cleared.

On the re-admission of the parties,

The CHAIRMAN said the Committee assumed that the agreed clauses would be inserted. They could not include clauses 5 and 6 in their present form; but with the alterations suggested by Mr. Hutchinson, they were willing to accept them. They could not agree to clause 8. With regard to clause 9, they suggested that, in the case of new laying of pipes in main roads, and in portions of the old area where they had not hitherto supplied, the depth should be 2 ft. 6 in. They did not wish the Company to alter existing pipes. Clause 10 they thought unnecessary; and they did not include clause 11.

The Bill, having been adjusted in accordance with the decision of the Committee, was ordered to be reported.

CHESHAM AND DISTRICT GAS BILL.

This Bill, the object of which is to dissolve and re-incorporate the Chesham Gas Company, extend their limits of supply, and authorize them to raise additional capital and maintain and develop their undertaking, came last Wednesday before a Select Committee of the House of Lords presided over by Lord SOUTHWARK.

Mr. HONORATUS LLOYD, K.C., who with Mr. A. M. PADDON appeared for the promoters, intimated that representatives of the Company had been in conference with others deputed by the Chesham Urban District Council, who had opposed the Bill, and that the parties had come to an agreement upon principle. A little alteration was involved in some clauses of the Bill, and he hoped to be able to make a statement at a further sitting of the Committee.

The Bill came again before the Committee on Thursday, when it was stated that an arrangement had not been definitely arrived at in regard to the contemplated amendments. The Committee therefore postponed further consideration of the Bill until yesterday (Monday).

Remarkable Explosion of Gas in a Well.—A number of men engaged in boring for underground water supplies at the Plum Cotton Mill, Heywood, recently had a somewhat alarming experience. For some time, Mr. John Tonge, of Rochdale, has been carrying out boring operations in the vicinity of the mill. The bore had been carried down more than 200 feet, at which depth a peculiar kind of gas issued from the hole, causing the water to bubble. The gas had no smell, but was highly inflammable; and the application of a light resulted in a blaze which shot up 4 or 5 feet. Messrs. Isler and Co., of London, were consulted; and they took down special apparatus and men. The day after they started work, Mr. Moores, the foreman, descended the well with a lighted lamp; but he had only got down a few yards when there was a violent explosion, by which he was badly burnt about the face, hands, and arms. A workman a few steps away from the mouth of the well was slightly burnt. A day or two later, there was another explosion in the well; and Mr. Tonge, who was carrying out further investigations, sustained slight injuries. Experts differ as to the kind of gas which has been discovered. One suggests that it is marsh gas; but a Home Office official who has made an inspection inclines to the opinion that it is a natural gas, as to the precise character of which he is not prepared to commit himself pending investigations.

MISCELLANEOUS NEWS.

SHEFFIELD UNITED GASLIGHT COMPANY.

The Annual Meeting of the Company was held on Monday of last week at the Cutlers' Hall, Sheffield—Mr. WILSON MAPPIN, J.P., in the chair.

The report and accounts for the year to Dec. 31, which were noticed in the "JOURNAL" for the 21st ult. (p. 542), having been presented,

The CHAIRMAN, in moving the adoption of the report, said: For the first time we are holding an annual meeting; and I shall therefore, in dealing with the accounts, have to make my comparisons with the two half years of 1909, which will make the figures appear larger than they have hitherto done. The authority for holding the meeting yearly instead of half yearly was contained in the Provisional Order, the various clauses of which, I may say in passing, were perfectly satisfactory to the Company, and which received the Royal Assent on Aug. 3 last.

MORE PROFIT, CHEAPER GAS.

I am sure you will share with the Directors the satisfaction they feel at the progress of the Company during the past twelve months. This is also a matter of importance to the consumers, as the more profit the Company are able to make, the cheaper will be the price of gas supplied to the public; the shareholders' interest in the business being limited to the 10 per cent. dividend, which cannot be reduced on either class of stock so long as the price remains below 2s. 9d. per 1000 cubic feet. It is therefore evident that, whatever the Company may be able to do in the way of economical working is for the benefit of the consumers. Turning to the accounts, there has been a decreased expenditure of £1312 on coal, £1341 on repairs of mains, and £133 on general establishment charges. The increased expenditure includes £1985 in stokers' wages, £13,464 in repairs of works, and £635 in rates. On the other side, we have received £11,333 more for gas—a very satisfactory item, when you consider that the average price at which gas was sold was only 1s. 2·94d. per 1000 cubic feet. The other principal items of increased income are: Meter and stove rents £520, coke £4024, tar £4385, and sulphate of ammonia £6076; the total result of the year's working, after providing for the dividend, being a surplus of £6486, from which has been taken the sum of £2533 to write off the reserve fund investments, in order that they may stand at their proper value in the Company's books.

GAS-HEATED FURNACES.

The number of additional meters fixed during the twelve months was 3050; and included in these were twenty 100 lights, seventeen 150, five 200, five 250, nine 300, three 400, one 500, two 600, and one 1500—the total number of meters at work on Dec. 31 being 98,736. Then, 1924 gas-fires, 1913 boiling and other stoves, and 19,758 incandescent burners were sold, and 402 additional gas-cookers were let on hire during the year. The additional number of gas-engines fixed was 68, varying in size from 1 H.P. to 175 H.P. On a previous occasion, I mentioned the business the Company were doing in gas-heated furnaces for various purposes connected with the Sheffield trades. A further 81 of these furnaces were fixed by the Company in 1910, and a few others by outside firms. The consumption of gas by them varied from 40 to 3600 cubic feet per hour. These furnaces are particularly suited for certain work, as the heat can be readily regulated to any temperature required. The following are some of the purposes for which they are used: Tempering table blades, Britannia metal work, annealing German silver and silver goods, steel tool hardening, lead and tin melting, forging files, hardening bayonets, heating fish-plates, heating shovels and machine-knife sections, wire hardening, hardening springs, heating bars, heating galvanizing tank, smelting brass, fork forging, forging crank-shafts, and annealing steel.

ELECTRIC SUPPLY.

The Electric Supply Department are appealing to the ratepayers to become users of electric current because it is supplied by what they term "their own department." From what I have already said, it will be seen that the ratepayers are equally, or I may say more, interested in supporting the Gas Company, as, the price being below 2s. 9d. per 1000 cubic feet, the whole advantage to be derived from increased business goes to the consumers. The Company, moreover, last year paid to the city authorities, in the shape of rates alone, no less a sum than £19,662; whereas the Electric Supply Department in 1909 only paid £2760, and this item in the case of the Electric Supply Department included income-tax. The electricians have what they call a "Publicity Department," whose occupation seems to be to turn out literature vilifying gas in all its uses. I have seen some of these pamphlets and leaflets; and they are so absurdly extravagant in their inaccuracies that, however gullible they may believe the public to be, I do not imagine for one single moment that the people of Sheffield will be taken in by them. Take, for instance, the question of the purity of the atmosphere, which they are never tired of saying is vitiated where gas is used, in spite of the fact that tests made by scientific men have proved their statements on this subject to be altogether inaccurate. Dr. F. S. Toogood, the Medical Superintendent at the Lewisham Infirmary, has recently been making experiments to determine the effect of the use of gas at the Institution; and after elaborate tests of the air of a room with gas burning, and another room exactly similar without gas, has arrived at the following conclusions: Firstly, that in both large and small apartments which have normal means of ventilation, gas consumed in modern incandescent burners can be used for lighting with no detriment to health—being found, in fact, to assist ventilation by the increased circulation of the air; and, secondly, that a gas-fire properly constructed and fixed not only does not vitiate the air, but is a valuable adjunct to the ventilation of the room.

GAS AND PURE AIR.

Let us look for one minute at the other side of the question. As you all know, the Council Chamber at the Sheffield Town Hall is electrically lit; and yet the condition of the atmosphere was found to have become so serious that the Medical Officer of Health had to test it scientifically, with the result that he reported that, when the air was at its worst, there was four or five times more carbonic acid gas in the air than in the street outside. Does anyone doubt that, had there been gas in the chamber, it would have been put down as the cause of the impurity; whereas the fact is that the heat from the gas would have caused a movement of air in the chamber, and thus have produced better ventilation. On this subject, Dr. Toogood says: "The carbonic acid produced by the combustion of coal gas is a chemically harmless, inactive gas. On the other hand, the carbonic acid produced by respiration of animals and persons is always associated with organic compounds, the inspiration of which is extremely hurtful to the human organism, resulting in a lowered condition of general health, which predisposes the subject to the attack of all bacterial diseases." These observations bear out the conclusions arrived at by numerous other eminent authorities who have made experiments the last few years.

MEDICAL OFFICERS' ACTION.

In the autumn of last year, the Society of Medical Officers of Health discontinued using the electric light at their premises in Upper Montague Street, London, and installed gas in its place. This naturally did not meet with the approval of the Electrical Press; and in December, Dr. Porter, of Marylebone, read a paragraph from one of the papers at the Society's meeting, and moved that the question be referred to the General Purposes Committee for consideration and report. Dr. Reginald Dudfield, of Paddington, replied: "Speaking as the Chairman of the Committee who had been entrusted by the Council with the supervision of the new heating, lighting, and ventilating arrangements, he considered it beneath the dignity of the Society to pay any attention to *ex parte* statements published in the Electrical Trade Press. He would merely add that no member who had experience of their meeting-room under the old conditions could deny the improvement that had taken place since gas had been substituted for the electric light and the new system of heating and ventilation had been installed." I understand the Sheffield Electrical Department, so as to acquire new business, are offering to supply current for lighting at a discount of 50 per cent., or 2d. per unit, on condition of the removal of all gas-burners from the consumers' premises. This does not appear to me to be a very fair method of competition; but even at 2d. per unit, and with their latest form of lamp, the cost of lighting by electricity would still be more than double that of gas. As to their right to charge new customers at lower prices than old ones who have for some years past had installations of electric light, I say nothing; it will be for them to look after their own interests in this respect.

THE LIGHTING OF ATTERCLIFFE ROAD.

Some of you may have seen in the Sheffield papers that the Electric Supply Department are agitating for permission to place electric lamps in Attercliffe Road; and it may interest you to know that the cost of the electric lighting of Fargate, High Street, the Moor, and the Wicker is about double that of gas. The lamps there are placed at from 40 to 50 yards apart; and I understand that it is proposed to fix them 76 yards apart in Attercliffe Road, and only to leave half of them lit after midnight, so that the lights would then be about 140 to 150 yards apart. I can leave you to imagine whether such an arrangement would be satisfactory or safe. Even then it would be considerably more expensive than the present gas lighting. I noticed a short time since that the Borough Engineer of Islington, replying to a question at the meeting of the Council, stated that the amount spent in the borough per annum for public lighting, including the cost of maintenance, is £28,337; that about 100 miles of street are lighted by gas at a cost of £13,112; and that 24 miles of street are lighted by electricity at a cost of £15,225. This is subsidizing their own department out of the rates with a vengeance. Further comment is unnecessary. In some parts of London—notably the City and Westminster—electricity has been superseded by high-pressure gas for street lighting; and if any of you happen to be going there, you will see in Victoria Street, Whitehall, Parliament Street, and Regent Street as fine a display of artificial lighting as has ever been produced. We could, of course, supply high-pressure lighting in Sheffield; but seeing that it could only be done, as in the case of electricity, at an extra cost (and surely we are already sufficiently highly rated), I do not myself see the necessity of extravagance in this direction. Of course, London being the Metropolis, with visitors from all parts of the world, and with its great amount of night traffic, is altogether exceptional.

The adoption of the report was seconded by Mr. WOOD, and carried.

The CHAIRMAN, in reply to a question as to how the reserve fund was invested, mentioned Consols, Midland preferred stock, Lancashire and Yorkshire debentures, and North-Easterns.

The usual dividend at 5 per cent. for the half year was then declared.

Mr. Hanbury Thomas was unanimously re-elected the Managing-Director, after highly complimentary references to his able management by the CHAIRMAN and the LORD MAYOR; and Messrs. J. D. Webster and R. G. Blake were re-elected also Directors.

Mr. G. H. HUNT, in proposing a vote of thanks to the Chairman, Directors, and officers, said it was interesting to know that gas was so largely used by many of the manufacturers in the prosecution of their business.

Mr. T. RICHARDSON, who seconded, called attention to the fact that the amount of bad debts—£1000—was larger than usual.

The CHAIRMAN, acknowledging the vote, said the reason the item referred to was larger was that it was for a year instead of six months.

A Reply for the Electricians.

On the Wednesday after the meeting, the "Sheffield Independent" published the following statements on the subject of the Chairman's allusions to electricity.

Mr. Wilson Mappin's speech at the annual meeting of the Sheffield United Gaslight Company has caused quite a commotion among the advocates of lighting and heating by electricity. The fact that the gas-works are owned by a private Company, while the electric supply is in

the hands of a Corporation Committee, naturally brings into hostile ranks many of our public men. The Committee's Chairman and one of the best-advised of the members of the body set forth at length their views on the matter.

Councillor Crowther writes us a letter in which he claims that the low price of gas in Sheffield to-day is due more to the keen rivalry of the electric light than to the management of the Gas Company, and that gas consumers owe a debt of gratitude to the Electric Light Committee, not only for compelling the Gas Company to decrease their charges, but for making them find out ways of improving their lighting accessories. Mr. Crowther continues: "Mr. Mappin complains also that the Electric Department advertise their business; my complaint is they do not advertise enough. If the Committee had the same freedom to push their business as the Gas Company have, they would stand even better than they do to-day." Referring to the vitiated atmosphere of the Council Chamber, which, Mr. Crowther says, has been considerably improved since the report quoted by Mr. Mappin was issued, he asks what would the atmosphere be if gas were substituted, and continues: "Why does not Mr. Mappin bring his persuasive powers to bear upon the Cutlers' Company, and induce them to substitute gas for electricity in the Cutlers' Hall? They tried the experiment once, with disastrous results. If gas is all that Mr. Mappin paints it, why do all the great trading concerns of the city waste their money in using electricity? Surely, as business men, they should reduce expenditure by substituting gas." As to the complaints of extra cost of street lighting as compared with gas, and the assertion that Fargate to the Moor costs double the sum previously paid for gas, Mr. Crowther claims that for the double cost we get five time the previous light. To light up Attercliffe Road with flame lamps will also cost considerably less per 1000-candle power than to light it with gas, and in addition to this will remove between thirty and forty gas-lamp standards that at present are an obstruction. If the Electric Light Committee had the lighting of the whole city, Mr. Crowther says, they would give a more efficient and reliable light than at present. They could make a better use of their existing plant with a slightly increased capital expenditure; and it would help them to reduce the price of current to consumers—and all this without any appreciable increased cost for street lighting, except where caused by increased light. The inference that new customers are better treated than older customers, is absolutely wrong, Mr. Crowther continues. There is no preference of any kind.

We have a long letter from Mr. C. F. Bennett, the Chairman of the Electric Supply Committee, in which he says it is not correct to state that the literature distributed by the Electric Supply Department "vilifies gas in all its uses." Any literature used naturally emphasizes the many points in favour of electricity. But because facts are mentioned which prove that electricity is more favourable than gas for the purposes referred to, it does not follow that the literature vilifies gas in the manner stated. The Gas Company are continuously issuing pamphlets in favour of gas; and the Electric Supply Department are merely endeavouring to show the public the reverse side of the picture. With reference to the question of the purity of the atmosphere, Mr. Bennett quotes Arthur Newsholme, M.P., F.R.C.P., Chief Medical Officer of the Local Government Board; the Medical Officer of the London County Council; Dr. George Carpenter, M.D., Editor of the "British Journal of Children's Diseases;" and the Hospitals Committee of Metropolitan Asylums Board, in favour of electricity. With regard to the discount of 50 per cent., Mr. Bennett refers to a minute passed by the Council in August, 1910, and points out that there is nothing in these conditions requiring the removal of all gas-burners from the consumers' premises, as stated by the Chairman of the Gas Company. With regard to the question of electric lighting of the Moor, Fargate, High Street, and the Wicker, Mr. Bennett says that it is not true the cost is double that of gas. If the comparison be made with the only figures available for public use, the cost of lighting the above-mentioned thoroughfares by electricity works out cheaper per candle power than was the case when they were lit by gas. With reference to the street lighting of the Islington Borough Council, Mr. Bennett says the Chairman of the Gas Company studiously avoided any figures relating to candle power which would not suit his argument—quoting figures to the advantage of gas, but ignoring the following: Total candle power: Gas, 190,044; electricity, 1,166,936. Cost per candle power per annum: Gas, 16·6d.; electricity, 3·13d.

EUROPEAN GAS COMPANY, LIMITED.

The Sale of Shares and the Issue of Bonus Shares.

An Extraordinary Meeting of the shareholders of this Company was held at Salisbury House, E.C., last Tuesday, principally for the purpose of confirming the resolutions passed at the extraordinary meeting held on Feb. 21 [see *ante*, p. 620]. The CHAIRMAN (Mr. R. Hesketh Jones, J.P.) presided.

The CHAIRMAN, in introducing the matter, remarked that they met on Feb. 21, and passed certain resolutions; the first one giving authority to the Directors to sell certain shares on the following terms: "That the Directors be and they are hereby authorized to sell 779 shares of the Company of £10 each, fully-paid, and 945 shares of the Company (£7 10s. paid) now and for many years past standing in the names of certain Directors of the Company as Trustees for the Company, upon such terms, whether by tender or otherwise, and at such time or times as the Directors shall consider expedient." The Directors offered these shares to the shareholders by tender. They had all been purchased and paid for at prices in excess of the reserve prices, and the proceeds had been re-invested in English railway debenture stocks. The first business on this occasion was to confirm the special resolution passed on Feb. 21, adopting the new Articles of Association. He therefore moved: "That the regulations contained in the printed document submitted to the meeting, and for the purpose of identification, subscribed by the Chairman thereof, be, and the same are hereby, adopted as the articles of the Company, to the exclusion of, and in subsitution for, all the existing regulations."

Mr. H. E. JONES seconded the motion, which was carried.

The CHAIRMAN said the next business was to declare a bonus in the terms of the resolution. He now begged to move—"That £250,545, part of the reserve fund of the Company standing to the credit of 'Depreciation and Redemption Account,' and representing accumulated undivided profits, be distributed among the shareholders registered as holding shares, or as holders of share warrants to bearer, on the 16th day of March, 1911, by way of bonus, free of income-tax, in proportion to the amounts paid or credited as paid on such shares at the date of this resolution, such bonus (which in the case of fully-paid shares will amount to £3 6s. 8d. per share, and in the case of shares on which £7 10s. is paid will amount to £2 10s. per share), being at the option of any shareholders applicable to the payment of the amounts then due in respect of any new shares or of calls."

Mr. JONES seconded this motion, which was at once passed.

The CHAIRMAN observed that the next business was to order the issue of the 16,203 new shares created at the extraordinary meeting on Feb. 21. He therefore moved—"That there be an issue of 16,203 new shares of £10 each.

Mr. JONES seconded this motion, and it was carried.

The CHAIRMAN moved the further resolution—"That the Directors be and they are hereby authorized to offer the said shares at par on the 16th day of March, 1911, to the shareholders holding shares at the date of this resolution which were fully-paid on the 24th day of February, 1911, in the proportion of one new share for every three fully-paid up shares, and that the nominal amount of such shares be made payable to the Company upon allotment on or before the 22nd day of March, 1911; such 16,203 shares to participate in any dividend declared after the 1st day of February, 1911, in respect of profits accrued up to March 31, 1911, other than the bonus above referred to."

Mr. JONES seconded the motion, which was passed.

The CHAIRMAN then moved the final resolution empowering the Directors to carry out the resolutions.

Mr. JONES also seconded this motion, and it was carried.

Mr. H. A. RIGG proposed a vote of thanks to the Chairman, which was seconded by Mr. W. J. HALLETT, and cordially passed.

The CHAIRMAN, in responding, said he was exceedingly obliged for the compliment paid to him. He thought they were very well through their business in connection with the bonus transactions; and he hoped matters would now go on satisfactorily. It was pleasing to get from the shareholders such a resolution as had been passed; and he thanked them very much for it.

COLONIAL GAS AND ELECTRICITY UNDERTAKINGS.

In addition to the reports of the two large Colonial Gas Companies whose proceedings have recently been noticed in the "JOURNAL" [see *ante*, pp. 711, 785], others relating to some smaller undertakings have reached us.

The sales of gas, &c., by the Brisbane Gas Company in the six months ended Dec. 31 last produced a revenue of £32,194; and the total receipts (inclusive of the carry-forward) amounted to £39,303. The expenditure being £21,375, there was a balance of £17,928. At the meeting early last month, the Directors recommended the payment of a dividend of 6 per cent., amounting to £9600. The income-tax on dividend and on distribution came to £600; so that there was a sum of £7728 to be carried forward. The Directors also recommended a distribution of 1s. 6d. per share from the land suspense account for the dividend reserve fund.

The report of the Directors of the Charters Towers Gas, Coke, Coal, and Light Company, Limited, contains several interesting features. The dates for making up the half-yearly accounts have been altered to June 30 and Dec. 31 respectively; so that the statement submitted at the general meeting was for the eight months ended Dec. 31. The gas-rates for this period amounted to £3304, against £2245 for the six months ended Oct. 31, 1909. The latter practically comprised the whole of the winter months' consumption for the year named; the former showed a consequent increase of more than 47 per cent. for an additional period of one-third (or two months) extra summer consumption. The increase was partly due to certain of the electric light consumers going over to gas, and partly to consumers who had not previously used either illuminant having had their premises fitted up for gas consumption. During the six months ended April 30, 1910, the Company, in common with coal consumers of all kinds, were very seriously handicapped by the coal strike. The Directors have deemed it wise to substantially increase their coal reserves, which now stand at 50 per cent. more than at the commencement of the period dealt with in the report; and it will be their policy to very gradually increase these reserves still further. The purchase by the Company of the Charters Towers Electric Supply Company's Lighting Order, plant, and business for the sum of £6500, took effect as from the 1st of July last; so that the revenue from the supply of electricity shown in the accounts is for a period of six months. The sale of current produced £1554; and there was a profit of £281. The Directors regard the position of the undertaking as satisfactory. The Engineer and Manager (Mr. C. A. Watson) and the staff under him have had special difficulties to contend with; and the Directors feel that the thanks of the shareholders are due to them for the manner in which they have fulfilled their duties.

The Maryborough Gas and Coke Company, Limited, had a net revenue of £2668 from the sale of gas, gas-fittings, &c., in the six months ended Dec. 31 last. With the balance brought forward, there was a sum of £1010 available for distribution at the annual general meeting; and the Directors recommended a dividend at the rate of 6 per cent. per annum. This required £773, and left £237 to be carried to the next account.

In the twelve months ended Dec. 31 last, the Napier (N.Z.) Gas Company had a revenue of £26,272 from the sale of gas; and coke, tar, &c., brought in £7157. The total receipts were £35,315, and the expenses £27,960; leaving a balance of £7355. An interim dividend was paid in June; and the Directors recommended that out of the above-mentioned balance a further dividend should be paid amounting to £5534—leaving £1821 to be carried forward.

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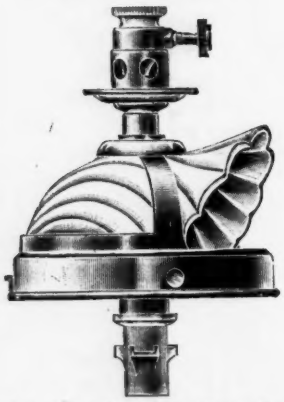

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DOVER GAS COMPANY.

At the Half-Yearly Meeting of this Company recently held at Dover, the accounts presented showed that the revenue in the six months ended Dec. 31 last amounted to £24,068, and the expenditure totalled £18,174; leaving £5894 to go to the profit and loss account. The balance available for distribution was £10,153; and the Directors recommended the declaration of a dividend at the rate of 7½ per cent. per annum, less income-tax. The Chairman (Mr. Willsher Mannering), in moving the adoption of the report, paid a tribute to the Company's late much respected Secretary, Mr. George Fielding, who had, he said, for upwards of fifty years proved of great value to them. The whole of the secretarial work now devolved upon his son, Mr. Ernest Fielding, who had for some years filled the position of Joint Secretary. Turning to the accounts, the Chairman said there had been an increase to the extent of 0·35 per cent. in the consumption of gas, which, though slight, was satisfactory. This had improved by £53 the revenue from the sale of gas. The total revenue had increased by £296; and the total expenditure had decreased by £171. The balance carried to the profit and loss was £5894, against £5425 before, or an increase of £469. The gross profit for the half year, including £176 received for interest, amounted to £6072. After charging interest on loans, income-tax, and writing off £250, the balance of the Trevanion street holder suspense account (this item now disappearing), and £250 for depreciation of stores, there was a net profit of £4500. This was sufficient to pay the usual dividend and leave £969 to be added to the surplus profit balance of former years, which would then amount to £6622. He congratulated the proprietors on so successful a result of the half-year's trading, and also on the strong financial position maintained by the Company. With reference to the current six months, the prospects were favourable; and the Directors anticipated being able to present as satisfactory a balance-sheet at the end of the half year as they now had the privilege of placing before the shareholders. The report was adopted. In the subsequent proceedings, regret was expressed by the Chairman at the absence, through illness, of the Resident Engineer, Mr. Raphael Herring. He said he was sure all would join in wishing Mr. Herring a speedy restoration to health. He also spoke in appreciative terms of the valued services rendered by their Secretary. Mr. Fielding thanked the Chairman for his remarks.

MUNICIPAL UNDERTAKINGS AT LEICESTER.

Presenting, at a special meeting of the Leicester Town Council last Tuesday, the financial statement of the gas undertaking for the half year to Dec. 31 last, Alderman T. Smith, the Chairman of the Committee, said the profit for the six months, after paying interest on the capital, was £29,798. After deducting £7715 for the sinking fund, a balance of £22,083 remained; and this, added to £25,644, the net profit for the half year to June, made a total of £47,727. Out of the year's profits it was proposed to hand over in relief of the rates £35,727, and place £12,000 to the reserve fund. The Committee had come to the unanimous decision that there ought to be some limit to the extent to which the Gas Committee should be bled in the interests of the ratepayers; and they felt that anything over £32,000 (which they promised for the present year) should be appropriated, firstly to the reserve fund, secondly to renewal of plant, and thirdly to giving the consumers further concessions. The Committee were considering the question as to whether they were sufficiently up-to-date with their plant; for they felt that they were not quite so modern as they would like to be.

The accounts of the electric lighting undertaking for the half year exhibited a profit, after paying interest on capital, and £3343 on account of sinking fund, of £1713. The profit for the half year ended June 30 was £635, making the total profit for the year £2348.

The Water Committee reported that the accounts of the undertaking for the half year showed a net profit, after paying interest on the capital of the undertaking, of £15,240. After deducting the sum of £3642, being the half-yearly payment to the sinking fund, a balance of £11,598 remained, which, added to £11,125, being the balance of net profit for the half year ending June 30, made a total of £22,723. This amount the Committee recommended the Council to carry to the credit of the special water fund created under section 164 of the Derwent Valley Water Act.

WELLINGTON (N.Z.) HOSPITAL LIGHTING QUESTION.

Electricity v. Gas—Municipal Competition with Private Enterprise.

In the "JOURNAL" for the 7th ult., reference was made to a controversy going on in Wellington (N.Z.) over the question of lighting the Hospital. Copies of the local papers which have since reached us show that the subject is still being discussed with warmth.

It may be remembered that about the middle of December last the Lighting Committee of the Hospital Board recommended the rescission of a resolution they had come to to renew the Gas Company's contract, in view of a specially favourable offer made by the City Council to supply electricity. The figures submitted were 3d. per unit for lighting and 1½d. per unit for heating; and as the former was 2d. per unit less than was charged to the Council's two largest customers—the Government and the Harbour Board—it seemed as though the price had been cut below paying point in order to keep the contract out of the hands of the Gas Company. A protest was promptly made by Mr. William Ferguson, the Company's Managing-Director, who sent a long letter to one of the local papers setting forth the claims of gas. It was promptly answered by Mr. George Lauchlan, the Electrical Engineer and Lighting Superintendent; and a newspaper war has since gone on between them.

The Lighting Committee deferred coming to a decision; and in the meanwhile they altered their constitution so that five out of the seven members were also members of the City Council. This looked very much like packing the Committee so as to ensure a vote in favour of the Council's offer. This was evidently the view taken by one of the members of the Board; for at a meeting of that body he proposed the addition of two more members of the Committee in order to lessen the weight of the Council's influence upon it. "How can competitors expect justice from such a body?" he asked indignantly. He said it was absolutely wrong that public bodies should be placed in such a position. The Chairman of the Hospital Committee denied that the Lighting Committee had been dominated by the City Council; and he assured the Board that everything that had been done had been perfectly fair. In the result, the proposed augmentation of the Committee was rejected by one vote.

Referring to the constitution of the Committee, a local paper said: "So far as the Board is concerned, the City Council must be treated, when it tenders to supply light and heat, as being simply a trading rival of the Gas Company. What would be said if the Board contained among its members shareholders or Directors of the Gas Company, and the Committee appointed to deal with lighting were almost entirely composed of these? Quite apart from this aspect of the position, it is highly undesirable that the City Council should indulge in cut-throat competition at the expense of the ratepayers. It is not private enterprise alone that will suffer if ratepayers are to be fought with their own money. It is deplorable that the Board should have failed to realize the impropriety of packing its Lighting Committee with agents of a concern (the Council) interested in the supply of light."

A few days later, the lighting question gave rise to a warm debate in the City Council, on a recommendation appearing in the report of the Tramway and Power Stations Committee that the Council should pass a resolution approving the action of the Electrical Engineer and Lighting Superintendent in "clearly demonstrating to the public that electricity for lighting purposes is cheaper than gas." On the recommendation coming up for approval, a councillor had the temerity to say he did not believe the statement was true. The Mayor (Mr. T. M. Wilford) said the Committee had passed a resolution in the belief that it was true. Generating the electric current cost 1½d. per unit and the capital cost was 2½d. Last year, the working expenses came to 3·082d. per unit; but this year, owing to the Parsons turbine, the amount was less—a huge saving having been effected. The Council could make terms this year and in future years that could never have been made before. A councillor remarked that the private consumer paid 7d. per unit; and he questioned if it would pay the Council to supply the Hospital at 3d. Why not, he asked, cheapen the price to the ordinary consumers, and thus have a greater number of them? After some further remarks, the following amendment was submitted: "That the Council approve the action taken by the Electrical Engineer and Lighting Superintendent in the offer to supply electricity to the Wellington Hospital at 3d. a unit for lighting and 1½d. a unit for heating." On being put to the vote, the amendment was carried. On the request of a councillor, the Mayor made a statement in which he quoted figures to show that the supply of current to the Hospital at 3d. per unit would result in a credit balance of £33 16s. 8d.—a return of £11 3s. 2d. per cent. on the outlay on the station plant.

Commenting on the proceedings summarized above, the Wellington "Evening Post" said: "Though the City Council has approved its Lighting Department's offer to supply the Charitable Aid Board with electric current at 3d. a unit for lighting and 1½d. for heating, it is plain that the battle about the two illuminants is far from finished. The 3d. quoted for the Board is 2d. cheaper than the price charged to large consumers in the city, and is 4d. below the ordinary tariff for private householders. Usually there are only one retail price and one wholesale price in the same market at the same time for the same commodity; but in the case of electricity the City Council's experts say that there are special factors to make the price 3d. in one quarter and 5d. in another. The ratepayers, for the present, have to accept the experts' report. The Mayor claims that the Corporation are acting honestly and fairly in the competition with the Gas Company; and he has declared that the sale of power to the Board at 3d. for lighting would leave a profit. . . . In this lighting matter, if the Corporation secure the contract on the terms mentioned, the ratepayers can only rely on time to test the statements made by the city experts. The officers are on trial, and they should have a fair trial. Very watchful eyes will be following the course of the experiment."

LECTURES TO IRONMONGERS' ASSISTANTS.

Mr. John Bond on Gas for Lighting and Heating.

The second of a series of lectures on "Gas Manufacture and Distribution," by Mr. John Bond, Gas Engineer to the Southport Corporation, was given at the gas-works, Crowlands, on Monday evening of last week, when about fifty ironmongers' assistants and workmen put in an appearance.

The lecture took the form of a description of the various processes in connection with the manufacture of gas and its bye-products and the testing of the illuminating power and calorific value, and apparatus used for heating purposes. In regard to the process of carbonization, the lecturer said 11,000 cubic feet of gas were realized from each ton of coal; and the coke for sale amounted to 10 cwt. per ton of coal carbonized. Great interest was taken in the plant used for the manufacture of sulphate of ammonia, and also in the Keith and Blackman high-pressure gas-lamp, which, it was pointed out, gave a most brilliant and pleasing light. The total illumination of the lamp amounted to 4500 candles; and it gave an efficiency of 60 candles per cubic foot of gas consumed. In the inspection of the laboratories, the special feature was a radiometer, which has been designed at the works by Mr. Bond, and is used for ascertaining the radiation efficiency of all classes of gas-fires. Mr. Bond stated that at present 12 to 30 per cent. of the total heat units passed up the chimney; and though this served to ventilate the room, he considered that in the future gas-fires could be so constructed that a considerable portion of this heat would be used for the purpose of warming the air of the room, so that greater economy might be secured in the system of heating by gaseous fuel.

GAS-HEATED HOT-WATER SUPPLY.

A Lecture at Brentford.

The subject of "Hot-Water Supply" was dealt with recently before the officials of the Brentford Gas Company in an instructive and interesting manner—Mr. Frederick Dye, M.R.I., author of the standard works on hot water (associated with the firm of Messrs. John Wright and Co., as chief of their Hot-Water Department) being the lecturer. A paper had been prepared, which was really a useful little treatise on the subject, well illustrated; but the lecturer considered his audience capable of reading this for themselves, and therefore devoted the time to discussing the reasons why certain methods or plans were followed in carrying out the work.

Practically every kind of apparatus designed to supply hot water at taps was dealt with; a full description being given of the details of connections of boilers and storage tanks, and all that goes to make such an apparatus, whatever its particular system, efficient. Several common ideas relating to the circulation of water in pipes, and what influences this movement, were proved to be misconceptions; it being shown, for instance, that the difference of levels at which pipes are connected in boilers and tanks is not a necessary feature to induce the circulation, as an equally strong circulation can be had with pipes quite level. A set of phenomena not commonly understood, or even thought of, was dealt with when describing what happens in an apparatus when the taps are opened. There is a common idea that the circulation influences—or, at least, has some relationship to—the movement of the water when a tap is opened. But this is incorrect, as all circulating movement and influences instantly cease, and a new set of actions set up, when a tap is turned on. This has an important bearing on efficacy; and it was shown that it is quite easy to have hot water in an apparatus, and yet find, on application to the taps, that none can be drawn.

Three designs of apparatus were dealt with—viz., the tank system, the cylinder system (with and without secondary circulation), and the cylinder-tank system. The special features of each system were gone into fully; and the proportions of parts were embodied in two tables. These tables set out the correct proportions of the parts of the different kinds of apparatus in connection with various sizes of kitchen-range fires and boilers. The need of this information lies in the fact that the gas engineer is frequently called in to provide assistance, either to a range-boiler under power, or to one that fails in some other respect; and it is necessary that he shall be able to see if the apparatus is at fault as to proportion—this allowing of some judgment being formed as to what assistance the gas-boiler is to give, or what deficiency it has to make up.

The more common hot-water failures were described; and the employment of the gas-boiler was then spoken of—the advantages of the firm's "Sun" combined boiler and storage, the utility of their "Calefactor" separate boiler, and the desirable qualities of both. The gas engineer can be assured that water heating by gas can now be classed as a practical thing; efficient heaters now being available, and the cost of heating the water being got down to a reasonable figure, with a certainty of results that coal-boilers can never ensure. Diagrams were provided showing how gas-boilers of both kinds are connected up to work in conjunction with range-boilers. This is the duty that very many gas-boilers will be employed to fulfil; and it is essential that the two boilers should work agreeably—one auxiliary to the other either way, or either working separately as required. In this respect, the tables referred to must be a help, enabling the inspector to gain some reliable guidance as to what is wanting to bring the installation to a state of efficiency.

An important adjunct of the gas-boiler was left to serve as a concluding subject; this being the service to be obtained from the thermostat, as a beneficial appliance for the gas engineer and the user alike. The speaker went so far as to convey that it is the thermostat that makes, and will make, coal gas, as a means of heating water, possible. He argued that the future use of gas as an agent for heating water must be largely based on the thermostat. No servant, however reliable, can regulate the gas consumption like a thermostat. Hand regulation under the very best conditions involves some waste; while often it brings about waste sufficient to condemn gas as a heating agent. For this, the boiler would receive the blame, not the servant. A thermostat was exhibited, and a demonstration given, and keen interest was displayed in noticing the way the appliance opened and closed the gas-valve instantaneously on meeting cold or hot water. It was noticed that, after being dipped in hot water, causing the gas to be shut down, the instrument was removed for a matter of seconds (while a few explanatory words were uttered), and during this brief time that the instrument was held in the air, it cooled sufficiently to open the gas-valve and give a full-sized flame. As the lecturer explained, a thermostat should work, and work sharply, when the water is quite hot or quite cold; while between times it should operate but very little. A simple crutch-head permits of adjustment so that any required temperature of water may be obtained.

Notwithstanding many opinions expressed to the contrary, Mr. Dye considered that the use of gas as an all-day means of heating water for tap supply is possible, with reliable consumption control. Gas may cost more than coal for all day use; but the extra cost is not sufficient to prove a bar to its employment any more than it is with many other applications. There are so many conveniences that people are willing to pay for—such as great cleanliness (compared with coal), reliable precise results, and saving of time. Saving of time often is as valuable as saving in fuel. For all short-period duties, gas, of course, is as cheap as coal, and sometimes cheaper. Perhaps the most notable example of this in convenience, saving of time and temper, and general excellence, is the way in which the gas-boiler will provide the pre-breakfast warm bath. The common fault of the kitchen-range—the want of a good supply of hot water before breakfast—is easily overcome with the gas-boiler; and if this were all the boiler had to do, it would soon oust the kitchen-range by its economical qualities alone.

The "Sun" gas-boiler (in use), the "Hotwell" water-heater, the "Garajo" boiler (for warming garages or rooms, or for general warming requirements), and the Wright thermostat, were shown.

HYDE GAS COMPANY AND LOCAL PLUMBERS.

At the last meeting of the Hyde, Denton, and District Trades and Labour Council, the Secretary stated that at the previous meeting he was instructed to forward a communication to the Hyde Gas Company, embodying several complaints made by plumbers with regard to the class of labour employed for fixing lamps, cooking-ranges, &c., and the wages paid. The communication was duly sent; and a reply had been received from Mr. Charles Potts, the Company's Secretary and Manager. In the course of it, Mr. Potts stated that his Directors did not admit the existence of any cause of complaint. He said: "Although our fitters do not serve seven years' apprenticeship to the various branches of the plumbing trade, they are nevertheless specially trained in one branch of it—*i.e.*, gas-fitting, which we undertake to execute in a skilful manner. This step has been rendered absolutely necessary by reason of the many complaints received from customers, which, upon investigation, were found to be solely attributable to the faulty fixing of internal gas-fittings and connections." He added that, owing to the changed conditions in the supply of gas now existing, arising chiefly from the severe and unfair competition with the Stalybridge, Hyde, Mossley, and Dukinfield Joint Tramways and Electricity Board, which is yearly "subsidized and bolstered up out of the rates of the four boroughs concerned"—the contributions of the Company to the local rates last year amounting to upwards of £1400—the Company were compelled, in order to retain their customers, to foster, by the cheapest and most reliable means possible, the continued use of gas for all purposes. His Directors were of opinion that the laxity shown by plumbers and gas-fitters hitherto was responsible in great measure for the present condition of their trade; and, looking to the interests of the shareholders and stockholders of the Company, they could not entertain any interference from trade societies, so long as they were doing their best for their customers in placing before them the cheapest, most efficient, and most economical appliances, suitable for all their requirements. After some conversation, in the course of which it was maintained that the Company were taking a portion of the plumbers' trade from them, and were not paying Trade Union labour to do the work, the correspondence was handed over to the plumbers' representatives, so that they might consider the various points, and report to the next meeting.

THE PROPOSED THAMES VALLEY RESERVOIRS.

Conference between the Water Board and Local Authorities.

In accordance with the intimation given in the "JOURNAL" last week, a conference, convened by the Metropolitan Water Board, between members of the Parliamentary Committee of the Board and representatives of the local authorities interested in the River Thames and its amenities, was held at the offices of the Metropolitan Asylums Board last Wednesday. Upwards of a hundred representatives were present. Models and plans illustrating the main points of the Board's scheme, particulars of which have already been given, were on view, and were referred to by the various speakers.

Mr. J. P. B. KARSLAKE, the Chairman of the Parliamentary Committee of the Board, presided, and stated that the Board were seeking to provide an efficient water supply for the growing needs of London on the lines suggested by the Balfour Commission of twenty years ago. He felt that the Board had just cause of complaint concerning the attacks that had been made upon them, as they recognized as much as their critics that the Thames was one of the chief playgrounds of the Metropolis, and that nothing must be done to destroy its beauty or damage its amenities. He directed attention to two models showing the Staines reservoirs, and explained that the Board's idea was to make works conform to the contour of the locality in which they were placed, so as to render them a pleasing feature of the landscape instead of a disfigurement. They also proposed to treat the existing banks of the reservoirs on the river in the same way, and so relieve the very monotonous aspect of the portion of the Thames between Hampton and Walton Another concession he had to announce was that, as soon as the first instalment of the proposed new works was completed, the Board would entirely dispense with the existing works at Seething Wells, near Surbiton, and so within a few years they would abolish the very ugly brick wall which had so long disfigured one of the prettiest reaches on the river. In conclusion, he said he thought he might fairly claim, on the balance of advantage, that the amenities of the river would gain at the expense of the utilities of the scheme.

Sir ROBERT HUNTER opened the discussion on behalf of the Thames Preservation League, and pointed out that the total area of the reservoirs which the Board proposed to construct was 5¼ miles, and that these structures would be about 40 feet above the level of the ground. He expressed himself as being very sceptical as to the ability of any engineer to produce a reservoir which would represent a hillside and be a thing of beauty. But the promised removal of the wall at Surbiton was a concession for which everybody would be grateful.

Mr. PAIN, of the Surrey County Council, and Mr. BASIL HOLMES, of the Thames Conservancy, urged that the reservoirs should be placed at a greater distance from the river; and several speakers appealed for the abandonment of the two reservoirs proposed to be built near Windsor and the one at Shepperton.

Mr. E. B. BARNARD, the Chairman of the Board, replying to the discussion, said the greatest opposition evidently centred against the two reservoirs near Bell Weir and the one at Shepperton. He was authorized to state that the Board were willing to withdraw from the present Bill the proposal for the reservoir at Shepperton. With regard to the other two, they were willing to meet the opponents by diminishing the size of the reservoirs, and keeping them 600 feet from the river. The Board would do everything in their power to preserve local amenities by calling in the aid of the landscape gardener.

The meeting closed with an expression of thanks to the Board for the concessions they had thus far made. From conversations which took place after the meeting, however, those referring to the reservoirs at Windsor and Eton were not considered as satisfactory.

NEW WATER SCHEME FOR PORTLAND.

Local Government Board Inquiry.

Mr. P. M. Crosthwaite, one of the Inspectors of the Local Government Board, recently held an inquiry at Portland into an application by the Urban District Council to borrow £1790 in connection with the water supply of the island and the new scheme to be carried out in the Portesham Valley.

The Solicitor to the Council (Mr. G. P. Symes) detailed the history of the scheme, and gave the results of the boring operations which had been carried out. Mr. Baldwin Latham, who had been consulted, suggested that the Council ought to sink a well and drive adits, at a cost of perhaps £32,000; but the Council decided to adopt the borehole plan, at about half the cost. The well scheme would take at least three times as long as the borehole scheme. The Surveyor (Mr. R. S. Henshaw) said the well scheme provided for a depth of only 150 feet; whereas the test pumping proved that they would have to go nearly 300 feet to reach water. He proposed to sink a 24-inch borehole to a depth of 312 feet, and then a 12-inch one to 375 feet. The first 100 feet would be bored 30 inches diameter, and lined with 24-inch cast-iron tubes, filled in behind with portland cement: the tubes to be fixed before the boring passed the 100-feet level. The water would be lifted by a pump, the exact type of which had not been decided. At present only one boring would be put down; and, if successful when tested to the full amount, another boring could be made. Mr. Percy Griffith, M.Inst.C.E., stated that he had been over the area in question and inspected it. His report was much the same as that of Mr. Henshaw; and he was sanguine that by the boring they would obtain a large supply of water if the borehole were large enough and the pump fixed at a sufficiently low level. He agreed that the water tapped above 311 feet was different from that tapped below this level, and was a local supply; whereas the lower level tapped a strong supply in the Portland sands. Referring to Mr. Baldwin Latham's well scheme, he said that in order to drive adits below water-level (and above this level they would be useless) it would be necessary to pump away a very large amount of water to allow men to work in the adits. To do this would probably, almost certainly, interfere with the supply at the higher well on which Portland at present depended. The well and adit scheme would cost £34,000; while the single borehole scheme would only cost £14,000, and a second hole and duplicate machinery another £6000—making a total of £20,000 in all. In these figures was included £3500 for the land. Asked how long it would be before the whole scheme could be completed, Mr. Griffith replied about eighteen months or two years.

Some opposition to the application was offered to Mr. B. Comben, who submitted that the deepening of the higher well and the driving of adits was the only scheme which would answer for Portland, which was a poor district, and could not afford two wells. In reply to a question, the Surveyor said the cost of carrying out this scheme would be £16,500. Other objections having been offered to the borehole scheme, the inquiry closed, and the Inspector visited the boring.

SOUTHAMPTON AND DISTRICT WATER SUPPLY.

At a recent meeting of the Southampton Town Council, the question of the supply of water in bulk by the South Hants Water Company, which had been brought forward at a previous meeting, was again under consideration. When the matter was originally before the Council, Mr. S. G. Kimber moved a resolution urging the appointment of a deputation to wait upon the Directors of the Water Company, with the view of negotiating for the purchase in bulk of the water supplied to the added areas of the borough, in order to bring about an equalization of rates. To this Mr. Chenerton proposed an amendment, referring the question to a Joint Committee of the Water and Parliamentary Committees of the Corporation. Mr. F. J. Smith, one of the supporters of the Corporation Bill, which the ratepayers refused to sanction, continued the discussion, and referred to the point of leasing or buying the pipes of the Company. If this was done, the Corporation would, he said, have to take the pipes in their present condition, and maintain and repair them for all time; and they would be at the mercy of the Company as to the price they would have to pay for the water. If, on the other hand, the pipes were leased, the Corporation would practically be in the same position. Even then they would only be in control of the distribution of water; and this was not what they required. The Company were at the present time intercepting the Corporation's supply. The watershed was the birthright of Southampton, and they were throwing it away for a mere mess of pottage. After further discussion, Mr. Kimber replied; stating that whatever the opposition had done they believed to be in the best interests of the town, and they were prepared to go on with it. He failed to see what harm a conference could possibly do; while it would strengthen the hands of the Corporation. It had been stated that the Company could not reduce the price; and, to be fair to their shareholders, they dare not reduce the charge for water in bulk. How did anybody know that? He maintained that if the Corporation went to the Company they would reduce the price; but they were afraid to go. A vote was then taken on the amendment, which was carried by 32 votes to 9. Mr. S. G. Kimber was then added to the Joint Committee.

At the annual general meeting of the South Hants Water Company a few days ago, the Directors reported that the profit shown by the revenue account was £18,287, compared with £17,110 for the year 1909. The balance standing to the credit of the profit and loss account was £18,554, out of which the Directors recommended the payment of a dividend at the maximum rate upon all classes of ordinary shares, which, with the interim dividend at the maximum rate paid in August, would absorb £13,288. It was proposed to transfer £1000 to the "back-dividends fund," and to carry forward £4266. The rent-roll during the year had increased by the addition of 1007 new houses, giving an estimated annual rental of £1059. The Chairman (Mr. W. E. Darwin, J.P.), in moving the adoption of the report, pointed out that the profit was £1177 more than last year. Their expenses were rather heavy; but there was an increase of £1060 in the annual rental, and of 1007 in the number of houses—a larger increase than for the last two years. The usual growth had taken place in the works department; and the rating had gone up by £236. With regard to the capital expenditure, the cost of the Company's last Bill was £4660. This was a large expenditure; but they could not help it. They had to take proper steps, as they had the opposition of the Corporation. They had to go to Parliament because they thought it necessary to obtain confirmation of the works they had carried out. They also took the opportunity of getting authority to cross the Hamble River, which, seeing that the river was tidal, they could only obtain from Parliament. Powers had also been obtained for an increase in the capital, in spite of the very energetic opposition of the Corporation; and now they had sufficient for ten years. In conclusion, the Chairman expressed regret at the absence of the Manager (Mr. G. Greenslade); but said he could state that the works were thoroughly efficient. The report was adopted. In acknowledging a vote of thanks accorded to the Chairman, Directors, officers, and staff, Mr. Darwin assured the proprietors that all did their very best for the Company.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Eastern District of the Scottish Junior Gas Association brought their session to a termination this afternoon, and set their house in order for next session. That they have done good work is sufficiently testified to by the fact that the Council were able, in their annual report, to recount no fewer than six promotions of members during the session. It would be incorrect to say that all of these movements flowed from, or even were affected by, membership in the Association; but it remains true that they were promotions of members, and the inference is not only permissible, but is on the surface, that the Association contains the best men in the profession, and that anyone wishing to be accounted as such ought to attach himself to the body. The Association have taken a step, in the resolution to drop proceedings during three months in the depth of winter and to prolong them into the summer, which may turn out to be not so happy in its result as it is well meant. In the spring of the year there is always a general turning away from study and studious habits; and it is to be feared that in the bright hours of the spring and summer evenings, attendance at gatherings of the Association will be confined to a few enthusiasts. Those who attend will, of course, receive the reward of their constancy; but a limited attendance means a restricted influence. This is certainly not in contemplation by the promoters of the new movement; and as it is only an experiment, if betterment should not be the outcome a change can be easily effected. At the meeting this afternoon, Mr. J. J. Scott, of Kennoway, read a very thoughtful paper on small gas-works, in which there was exemplified that quality which has been frequently referred to as being more highly developed in managers of small works than there is evidence of its being in the case of those who have large works under their charge—that of ready adaptability to circumstances. The man in a large works has everything to his hand; in a small works, the manager has to "cast about" till he is able to grasp something he can make do. Mr. Scott did this in his method of obtaining the necessary pressure to work the automatic lighting and extinguishing appliances on the street-lamps; and he arrived at a very ingenious method of doing the work.

What is termed the annual meeting of the Edinburgh and Leith Gas Commissioners was held on Monday last, with Provost Smith, of Leith, in the chair. Bailie Bryson reported that the Works Committee recommended that the price to be charged the Corporations of Edinburgh and Leith for gas for public lighting should be, after May 1, 2s. 3d. per 1000 cubic feet for incandescent lamps, and 2s. 7d. for flat-flame burners. Public lighting includes the lights in common stairs as well as street-lamps. The Finance and Law Committee recommended that the Commissioners should come into line with the other borrowing trusts in the city, that the interest on money borrowed should be at the rate of 3¼ per cent., and that commission for introducing business should only be paid to accredited agents. These recommendations were agreed to. The Finance and Law Committee also recommended that two representatives of the Commission be sent to a conference to be held under the auspices of the Institution of Gas Engineers. Bailie Pennell reminded the Commissioners that at their last meeting they resolved not to enter into an association which required an annual assessment of about £265 from them for development purposes. They did not feel that they would gain any advantage corresponding to the annual assessment. They certainly arrived at that decision without the presence of Mr. Herring. He (Mr. Herring) was now with them; and the proposal was to go back upon what they then did. He moved the previous question. Judge M'Michael, in seconding, said that a good many of them were inclined to look upon the whole matter as a joke. Bailie Lindsay, of Leith, pointed out that they had information before them now which they had not previously. They were told that their drawings for gas consumed were down more than £10,000. A certain proportion of this reduction was said to be due to the lower price of gas; but they had sold 60 million cubic feet of gas less than in the corresponding period of last year. On a previous occasion, he and one or two other members of the Commission very strongly pushed the introduction of prepayment meters; and it was just possible that this question, and other ways for the consumption of gas, might be brought up at the conference. He really thought, therefore, that they would be wanting in enterprise and business foresight if they did not attend the conference. In the course of a discussion which followed, it was suggested that Mr. Herring would be present at the conference, and that the interests of the Commission would be safe in his hands. By the casting vote of the Chairman, it was agreed to send representatives to the conference; and Judge Inches and Mr. Canning Williams, the Treasurer and Collector, were appointed for the purpose.

The proceedings in London connected with the Kirkcaldy gas transfer were, as reported in the "JOURNAL" this week, brought to a close on Saturday of last week. How they are regarded in the locality may be

gathered from a statement made in the Kirkcaldy Town Council on Monday by Bailie Wright, who is Convener of the Gas Committee. Replying to a question, he stated that the action taken at the last Council meeting had been very effective in making the tribunal alive to thenecessity of getting the proceedings closed as quickly as possible. Lord Shaw intimated that the papers from the Arbiters would be in his hands that day week; and he would not keep them long before giving his decision. In order that their anticipations might not be disappointed, he should like to explain that in the discussion of the question they were led to believe that the balance of profits of the Gas Company amounted to only £4500 a year, whereas they now found that the profits were actually £6500. This had been accepted as the profit on both sides; and the difference would be accounted for in the decison arrived at.

In the Hamilton Town Council on Tuesday, the Gas Committee recommended that the price of gas to all consumers beyond the burgh boundary be 2½d. per 1000 cubic feet above the rates payable in the burgh. This was agreed to.

As a sort of reply to the experiments in street lighting by means of metallic filament electric lamps in Aberdeen, the Gas Department of the Corporation have had a number of gas-lamps of an improved pattern fitted up in west-end thoroughfares contiguous to the electric lamps. Upright incandescent gas-burners in seventeen lamps have been superseded by Cowan's patent two-light inverted gas-burners, giving a light of about 150-candle power per lamp. There have also been fitted up ten other two-light inverted incandescent lamps, hung by brackets on tramway poles. These lamps give a light of about 240 candles each. On the evening of Tuesday last, this latest installation was on view, and the members of the Corporation who are interested will report to their respective Committees as to the experiments.

The Gas Committee of the Dunfermline Town Council on Monday reported to the Council that at a meeting on the 3rd inst. they heard a full explanation from the Engineer—Mr. A. Waddell—as to the advantages to be gained by installing vertical retorts at the gas-works, and that, after fully discussing the matter, the Committee, with one dissentient, agreed to ask authority to erect an installation of twenty-four vertical retorts. In the Council, Bailie Nornal proposed that the authority asked be granted. The estimated cost of the installation was £2000 or £2500. Mr. Waddell considered that a saving of about £800 per annum would be effected by the use of vertical retorts. Mr. Bowie moved the previous question. On a division, the minute was adopted—only the mover and seconder of the previous question voting against it.

On Monday, Sheriff-Substitute Moffatt gave his decision in the matter of the prosecution by the Corporation of Falkirk of Bailie Henry Russell, one of their number, who was charged with having used gas for lighting purposes which had been supplied to him for power, through a separate meter, at 5d. per 1000 cubic feet less than the charge for lighting. As stated last week, the accused objected to the relevancy of the complaint, on the grounds that it did not sufficiently specify the Statute which was alleged to have been contravened, and that what was said to have been done was not an offence under section 18 of the Gas-Works Clauses Act of 1847. The Sheriff repelled the first objection, as he thought the specification was sufficient. The second objection he upheld, and dismissed the complaint. In his opinion, section 18 of the Act of 1847 does not apply to gas which is supplied through a meter. The complainers founded upon the clause in the section, "or who shall otherwise improperly use or burn such gas." The accused contended that "such gas" meant gas not ascertained by meter; and that therefore the section did not apply to the circumstances set forth in the complaint. This contention must be upheld. In the part of the Act headed "Supply of Gas" and "Undue Use of Gas"—being sections 13 to 20—the word "gas" is used throughout without the qualification of "such," except in the clause under consideration. If it had been intended that any improper use or burning of the gas supplied under the Statute should be an offence, the section would just have said "gas" without any qualification. He could not otherwise construe the section than by reading it as meaning that improperly using or burning of "such gas" meant improperly using or burning gas not ascertained by meter. It was said by the complainers that if this section were not to apply, then they had no remedy if anyone used gas in the manner alleged there. They might not be able to enact a penalty, and, of course, they could not if there were no statutory right to do so; but he had nothing to do with that. Omissions in Acts of Parliament were neither unknown nor uncommon. The Corporation were found liable in one guinea of modified expenses. The representative of the Corporation asked that a case for appeal be stated.

Sale of Stocks and Shares.

At the Mart, Tokenhouse Yard, E.C., last Tuesday, Messrs. A. & W. Richards offered for sale, under instructions from Directors, three new issues of capital, all of which found ready buyers. The first lots consisted of 500 "C" shares (£10) in the Harrow and Stanmore Gas Company, ranking for a standard dividend of 7 per cent., subject to the sliding-scale; the last dividend on similar shares having been at the rate of £7 7s. per cent. per annum. They fetched £15 10s. to £15 15s. each. The Lowestoft Water and Gas Company offered 400 additional ordinary £10 shares and £1000 of 4 per cent. perpetual debenture stock. The shares rank for 7 per cent. maximum dividend equally with similar shares now receiving 5¾ per cent. per annum; and they were all sold at £10 10s. to £10 17s. 6d. apiece. The debenture stock realized £104 10s. to £104 15s. per £100. The third new issue was by the Dartford Gas Company, who offered £5000 of ordinary stock, ranking for a maximum dividend of 5 per cent. per annum—a rate which has been paid for many years on similar capital. It fetched £102 to £102 10s. per £100. On the same occasion, 176 fully-paid £10 "B" shares in the Tendring Hundred Water Company, ranking for a maximum dividend of 8 per cent., but carrying 4½ per cent., fetched £11 7s. 6d. to £11 10s. each.

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CURRENT SALES OF GAS PRODUCTS.

[For Table of "Tar Products Prices," see p. 871.]

LIVERPOOL, *March* 18.

Sulphate of Ammonia.

The volume of new business for early shipment has been somewhat restricted throughout the week. There has, however, been good demand for covering contracts made previously for March delivery, which, coupled with a fair amount of inquiry in the home trade, has been sufficient to prevent a further decline in values. At the close, the tone of the market is quiet but steady, and quotations remain £14 5s. to £14 6s. 3d. per ton f.o.b. Hull, £14 6s. 3d. to £14 7s. 6d. per ton f.o.b. Liverpool, and £14 7s. 6d. to £14 8s. 9d. per ton f.o.b. Leith. In the forward position, few first-hand transactions have transpired; but it is reported that £14 per ton f.o.b. Liverpool has been paid for May-June delivery, and £13 12s. 6d. per ton f.o.b. Leith for July-December, in equal monthly quantities.

Nitrate of Soda.

This article continues rather slow of sale; but the spot prices are still given as 9s. 7½d. per cwt. for ordinary and 9s. 10½d. for refined quality.

LONDON, *March* 20.

Tar Products.

The markets for tar products have remained fairly steady during the past week. Pitch is unchanged, and there is not a large amount of inquiry. Fair quantities of benzol have been offering for forward at reduced prices without success. Naphthas are very steady. Creosote is quiet, though the prices do not move.

The average values during the week were: Tar, 17s. 9d. to 21s. 9d., *ex* works. Pitch, London, 35s. 6d. to 36s.; east coast, 35s. to 36s.; west coast, Manchester, 35s. 6d. to 36s. 6d., Liverpool, 35s. 6d. to 36s. 6d., Clyde, 35s. 6d. to 35s. 9d. Benzol, 90 per cent., casks included, London, 9d. to 9¼d.; North, 8½d. to 9d.; 50-90 per cent., casks included, London, 9d. to 9¼d.; North, 8½d. to 9d. Toluol, casks included, London, 9⅜d.; North, 9¼d. Crude naphtha, in bulk, London, 4d. to 4½d.; North, 3½d. to 3¾d.; solvent naphtha, casks included, London, 11½d. to 1s.; North, 10½d. to 11d.; heavy naphtha, casks included, London, 11⅜d. to 1s. 1d.; North, 10¾d. to 11d. Creosote, in bulk, London, 2¼d. to 2⅜d.; North, 1⅞d. to 2¼d. Heavy oils, in bulk, 2⅜d. to 2⅝d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 9d. to 1s. 9½d.; west coast, 1s. 8d. to 1s. 8¼d. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 45s., bags included. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

Although the market has remained firm, business has been particularly quiet during the past week. To-day, actual Beckton is quoted £14. Outside London makes 25 per cent., £13 15s. to £13 17s. 6d. Hull, £14 6s. 3d. to £14 7s. 6d. Liverpool, £14 7s. 6d. to £14 8s. 9d. Leith, March-April, £14 10s. Middlesbrough, £14 6s. 3d.

COAL TRADE REPORTS.

Northern Coal Trade.

There is a good demand for coal; but the stormy weather has delayed shipments, so that work at the collieries has been rather irregular. In the steam coal trade, best Northumbrians are from 10s. to 10s. 3d. per ton f.o.b., with a good demand for this season. For second-class steams, from 8s. 9d. to 9s. is quoted; and for steam smalls, from 5s. to 6s. 3d.—the latter class being in fair request. In gas coals there is a fair inquiry; but the home demand is now less. Durham gas coals vary in price. The usual classes are from 8s. 6d. to 9s. 3d. per ton f.o.b., according to quality; while for "Wear" specials, up to 10s. 6d. is quoted. Among the contracts, the most important are those for the Newcastle and Gateshead Gas Company. They are for about 300,000 tons, from July next to June, 1912, and the price varies from 8s. 10d. to 9s. per ton, which is nearly a shilling per ton below the prices under the contracts that are now drawing to a close. In addition, some relatively small contracts for gas coal for Danish and German gas undertakings are being closed at somewhere near the prices that are current. There are also one or two sales for south-country companies. In coke, the market is steady. Gas coke is now rather less plentiful; so that the output is well taken up, at from 14s. to 14s. 6d. per ton f.o.b. in the Tyne for good quality.

Scotch Coal Trade.

Trade is slack, with prices easier. The only sorts in demand are washed stuffs and dross. Though there is a present dulness in business, there is an expectant feeling of a cheerful nature. The prices now quoted are: Ell, 9s. to 9s. 9d. per ton f.o.b. Glasgow; splint, 9s. 9d. to 10s.; and steam, 9s. to 9s. 3d. The shipments for the week amounted to 298,188 tons—an increase of 7148 tons upon the previous week, but a decrease of 11,797 tons upon the corresponding week last year. For the year to date, the total shipments have been 2,755,235 tons—a decrease upon the corresponding period of 26,346 tons.

Gas Coal Outlook in the Midlands.

In last Tuesday's "Financial Times," a correspondent wrote as follows: Contracts for gas fuels are mostly arranged for twelve months from July 1; and, though it is rather early in the season for negotiations to commence, there are already a good number of inquiries for tenders, among which are the Salford Corporation. It is stated on good authority that a considerable tonnage has been arranged. Last year, contracts renewed early in the season were at advances of 1s. per ton; while for those arranged later on better terms were obtained by buyers. A large tonnage was placed at only 6d. per ton advance; and on several large contracts the advance was even less. Production of gas coals has not materially increased during the last few years; and the fact that the railway companies obtained reductions of 6d. per ton on renewal of their steam-coal contracts—chiefly, no doubt, owing to the largely increased production—should not be taken as a comparison. Nevertheless, gas engineers are looking for reduced

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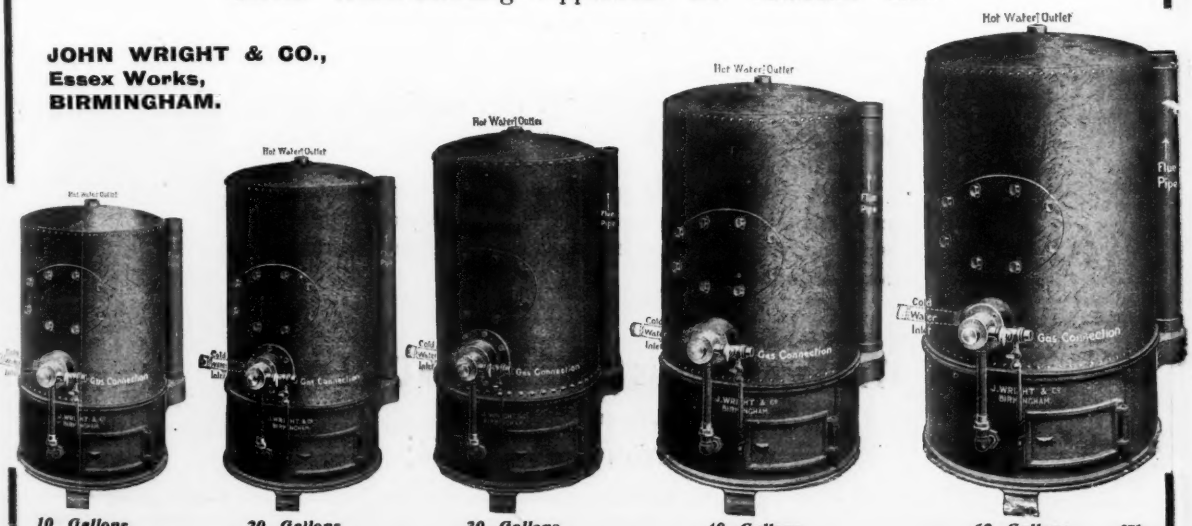

10 Gallons. *20 Gallons.* *30 Gallons.* *40 Gallons.* *60 Gallons.* 271.

prices. It is generally understood in the trade that a reduction of 3d. per ton would be a generous one under the circumstances, especially considering that, in spite of the advances obtained last year, the balance-sheets of collieries who place a large proportion of their output on the gas-coal market have not shown any greatly increased profits as compared with the previous year—though, of course, they only include six months' trading at the advanced figures, from July 1. From a colliery point of view, gas coals are on too low a basis, brought about by the severe competition some years ago, when orders were accepted at figures that resulted in a direct loss. But with the increasing consumption of gas fuels, and the extended use of gas for power and heating, it is possible that the market will have more stability in the near future, as there is no likelihood of any greatly increased production. So far as can be seen at present, no contracts will be renewed at reductions of more than 3d. per ton.

An Action over a Gas Escape in Dublin.

At the Dublin City Sessions last Wednesday, before the Recorder, Mary Foy, a widow, sued the Alliance and Dublin Consumers' Gas Company to recover damages for injury to health alleged to have been occasioned by an escape of gas from a disused meter which had been left in the house after she had asked for its removal. The Company denied liability. Plaintiff, it appeared, went into occupation of certain rooms at the end of September or beginning of October; and she soon perceived that there had been an escape of gas from the prepayment meter. It injured her health, and prevented her from attending to her business; and she had to consult Dr. Sigerson. But she was otherwise ill, besides the effects of the gas upon her. The meter did not work until she had put in three pennies. She went to the Company's office and complained of the escape; and the Company sent men to examine the pipes and the meter, but there was no improvement. The meter was subsequently changed. Two fitters in the service of the Company deposed that they examined the meter, and found no escape of gas. There was, however, a bad smell of a different kind in the room. A witness named Kennedy said that if three pennies were put into the gas-meter in order to get a pennyworth of gas, it was an indication that there was something wrong with the works of the meter. Mr. Leadbetter, an official of the Company, said the plaintiff presented him with a bill for 26s., which she said she had paid for medicine in consequence of the effect of the gas upon her. The Recorder said he would like to have the opinion of Dr. Sigerson as to whether or not the inhaling of gas by the plaintiff had anything to do with her illness when he saw her. The Gas Company, he felt sure, would do what was right, if they were told by Dr. Sigerson that the gas had anything to do with the plaintiff's illness. For the Company, Mr. Fitzgerald said that his clients would be willing to act upon this suggestion, and compensate the plaintiff; but the question was how much she ought to get. The Recorder remarked that he knew Mr. Cotton, and felt sure the Company would act fairly. On this condition, he dismissed the action on the merits, but without costs against the plaintiff.

Prepayment Meter Thefts.—Writing to one of the Birmingham papers, an anonymous correspondent says: Will you kindly allow me space to call attention to the lot of users of the penny-in-the-slot gas-meters? They get less gas for their money, no discount for money paid, and last, but not least, have to refund any money stolen, and also pay for the repair of the meter. Is it beyond the power of the Gas Committee to formulate a scheme whereby metal discs could be substituted for pennies? Such a scheme would not only put a stop to these petty thefts, but would also be a boon to poor people, who can ill-afford to be robbed in this manner. I trust this will meet the eye of someone who will move in the matter.

The Sale of the Whaley Bridge Gas Undertaking.—The sum to be paid by the Chapel-en-le-Frith, Chinley, and District Gas Company for the undertaking of the Whaley Bridge Gas Company is £8500. Some time ago, when negotiations were entered into between the Whaley Bridge Council and the Gas Company to acquire the gas-works for the ratepayers, the Directors of the Company offered to sell at £7000. The offer, however, was eventually declined by the members of the Council; and steps were taken by the Local Authority to oppose the Company's Bill in Parliament, with the object of securing the insertion of a purchase clause. As the Chapel-en-le-Frith Company seek to include in their Bill now before Parliament the statutory powers sought by the Whaley Bridge Gas Company, it is assumed the Council will oppose the new Company with the same object in view. It is understood that eventually the purchasing Company will erect new and up-to-date gas-works at Bugsworth to supply the whole district, and thus be able to dispense with the existing works at Whaley Bridge and Chapel-en-le-Frith.

Lichfield Gas Company.—At the annual meeting of this Company last Tuesday, the Chairman (Alderman G. Haynes, who presided in the absence of Alderman H. M. Morgan on account of ill-health) stated that though 30 tons less coal had been used, upwards of a million cubic feet more gas had been sold in the past twelve months than in the year 1909. He reminded the meeting that twelve months ago he outlined the Directors' intention of extending the Company's mains on the Walsall Road. He could now inform them that some 3¼ miles had been laid, and 40 consumers were using gas; and at the present time they were extending the mains for a further three miles into Hammerwich and Burntwood, with good prospect of having another 150 consumers. The modern method of extending the supply of gas for long distances to outside districts by means of steel mains and a compressor was much cheaper than was possible a few years ago with cast-iron pipes. The usual dividends were declared. In proposing a vote of thanks to the Manager (Mr. F. Key) and the staff, the Chairman spoke of the increased duties falling upon the Manager, who, he said, was always ready to meet any requirement the Directors made upon him. In responding to the vote, Mr. Key mentioned that in Lichfield it had taken 27 years for the output of gas to double itself; but with the present enterprising Board of Directors, it would be considerably less than this period before it would be doubled again.

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Claim for a Water Tunnel under a Grouse Moor.

At the Surveyors' Institution, Westminster, on the 11th inst., arbitration proceedings took place in regard to a claim made against the Sheffield Corporation by Mr. W. Wilson, of Beauchief Abbey, for compensation for easement in respect of the tunnel constructed beneath his property at Stanage and Hallam Moors in connection with the Redmires and Rivelin reservoirs of the Corporation. Mr. W. Terrey and Mr. Smith Denton were the Arbitrators; Colonel Wellstead was the Umpire. Mr. C. C. Hutchinson, K.C., and Mr. Ellison appeared for the claimant; Mr. Honoratus Lloyd, K.C., and Mr. Waddy represented the Corporation. Mr. Hutchinson stated that the amount of the claim was, in round figures, £5000. The tunnel was some four miles in length, and ran through the claimant's land for a distance of 3798 lineal yards at a depth of from 770 to 530 feet. For the easement the claim was £1450, the remainder being for injurious affection of the grouse moor. He called Mr. Henry Hanson, who said he estimated 3798 lineal yards of easement at 5s. per yard, £950, *plus* 10 per cent. for compulsory purchase, £95—total, £1045. He placed the injurious affection at £4000. Mr. Lloyd called Mr. Edward Holmes, who stated that the easement was non-apparent, and in his opinion would not in the slightest measure affect the value of the moor. Having regard, however, to the fact that they were technically taking something from the claimant, he would pay him £100 as nominal damages. Mr. James Watson, the Water Engineer to the Bradford Corporation, said that his valuation was: 3798 lineal yards of the easement, at 6d. per yard, £95, 10 per cent. added for compulsory acquisition; making in round figures £105. Mr. E. M. Eaton thought if the claimant were paid 1s. per lineal yard it would be ample, as he sustained absolutely no injury. Mr. Lloyd, addressing the Umpire, urged that the claim was an exaggerated one; while Mr. Hutchinson contended that the evidence had amply borne out his claim of 5s. per lineal yard for the easement. The award was reserved.

Monte Video Water-Works Company, Limited.—In the report to be presented at the ordinary general meeting of this Company on Thursday, the Directors state that the net receipts for the year ended Dec. 31 last were £106,301, compared with £93,247 in 1909—an increase of £13,053. Including the balance brought forward, but deducting the debenture interest, the interim dividend, &c., there remains £96,228. The Directors propose a final dividend of 5 per cent., making 8 per cent. for the year, tax free; and they recommend that sums of £10,000 should be placed to depreciation and reserve funds, and £1500 to the staff provident fund, leaving £37,228 to be carried forward. The number of services in operation at the end of 1910 was 21,426, compared with 18,519 at the close of the previous year; being an increase of 2907. The Directors attribute this large increase to dry weather and the rapid development of building in Monte Video. In order to provide for capital expenditure in prospect and to release part of the reserves at present employed in the business, it is considered necessary to increase the capital by £100,000.

Prepayment Meter Supplies at Carlisle.

It was reported at last week's meeting of the Carlisle Town Council that, in accordance with the instructions of the Gas Committee, the Engineer (Mr. Harold Bloor) had further reported upon the proposed supply of gas cookers or grillers free of charge to slot-meter consumers, and that the Committee had passed the following resolution: That the price of gas supplied to slot-meter consumers in the city be reduced from 2s. 9d. to 2s. 6d. per 1000 cubic feet after March 31, and that such consumers be given the option of having the use of either a cooker or a griller free of charge. The Town Clerk having explained that further information had been circulated on this question, it was agreed that the whole thing should be gone into again *de novo*. A long discussion then took place on the question, the further consideration of which, it may be recalled, had been adjourned at the previous meeting of the Council. Some members were of opinion that the price should be reduced to that paid by the ordinary consumers—2s. 3d. per 1000 cubic feet—while quite a number of speeches were made in opposition to the supply of free cookers or grillers. In the end, the Committee's suggestion to reduce the charge to prepayment consumers from 2s. 9d. to 2s. 6d. per 1000 cubic feet was agreed to; but the proposal with regard to supplying cookers or grillers free of charge was lost by a large majority.

Concession to Slot-Meter Users in Manchester.

At their meeting last Friday, the Gas Committee of the Manchester Corporation had under consideration the question of conceding to consumers by prepayment meter a larger quantity of gas for 1d. than is now supplied. After considerable discussion, it was decided to recommend the Council to supply 33 cubic feet of gas for 1d.; this being 3 cubic feet more than is given at present. There are upwards of 61,000 prepayment meters in use in the Manchester gas supply area; and the charge of 1d. for 30 cubic feet works out at 6d. per 1000 cubic feet more than is paid by the ordinary consumers. According to some statistics presented to the Council in January last, when the position of the slot-meter users was being considered, there were then in the gas-supply area 117,000 ordinary consumers and 61,000 of the prepayment class. The quantity of gas consumed by the former in a year was 4420 million cubic feet; and by the latter 540 million cubic feet. The Gas Committee at Friday's meeting also discussed the question of reducing the price of gas to large and to ordinary consumers. The matter was deferred, however, to see what amount will be demanded by the Council from the Gas Department in aid of the rates. Last year the sum handed over was £50,000.

The Middlesbrough Gas Committee have recommended the Council to increase the salary of Mr. C. F. Blincoe by £20 per annum, and that he should be given the appointment and status of Assistant Gas Manager.

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Davis Gas-Stove Company, Limited.

Moving the adoption of the report and accounts (*ante*, p. 796) at the annual meeting of the Davis Gas-Stove Company (which was held last Wednesday, at the Cannon Street Hotel, E.C.), Mr. H. J. Davis said that, if the shareholders would refer to the profit and loss account, they would see that the profits for the past year amounted to £14,565, while for the previous twelve months they were £13,602. Thus on the present occasion there was a net increase of £963. Though this was not a large addition, he was of opinion that, having regard to the keen competition prevailing in the gas-stove and foundry trade, they had every reason to be satisfied with the results attained. It was proposed to pay exactly the same dividend as a year ago—namely, at the rate of 10 per cent. for the half year, making, with the interim dividend at the rate of 5 per cent. already paid, 7½ per cent. for the year. It might be contended that a larger dividend might have been paid, and a less amount retained in hand or carried to reserve. Such a step would have been quite permissible; but the Board were unanimously of opinion that their first duty was to strengthen the basis upon which the Company rested, and this could only be done by building up the reserve. Therefore the Directors had decided to resist the temptation to make a larger distribution of profits until the Company grew stronger; and personally he was sanguine that this date would not be long deferred. For the previous year £5149 was added to the reserve; and now it was proposed to add £6000, so that the reserve would stand at the very substantial figure of £30,000. This increase had not been made at the expense of the amount brought forward from the preceding year, as some £300 more was carried forward now than was brought over at that time. Mr. Harold N. Davis, in seconding the motion, remarked that anyone who possessed a knowledge of the gas-stove trade and the general foundry trade would admit that 1910 was not an exceptionally brilliant year, to say the least; but so far as their Company were concerned, the trade in both departments was an absolute record for them. Unfortunately, competition had been extremely severe; but this had been counteracted to a very great extent, so far as the profit and loss account was concerned, by more economical methods of working. They had installed modern machinery, which had not only enabled them to produce their goods more cheaply, but to make them much more efficient. It was necessary now that parts of gas-stoves should be strictly interchangeable; and by means of special machinery they had introduced, they had been able to secure this most important factor. They had put down an up-to-date enamelling works at Luton, which was not practically completed until towards the end of 1910, so that no benefit from it was shown in the accounts under review. It would, however, benefit them in the future. The laboratories and experimental department had become an important feature of the works. Science and practice were being combined in the development of modern gas appliances—thus sowing the seed for what the Directors hoped would be a very rich harvest in time to come. The resolution was carried unanimously; and Mr. Harold Davis was re-elected a Director.

Idle Gas-Works in Danger.—On the night of the 10th inst., the Albion Mill at Idle, in the West Riding of Yorkshire, was burned to the ground. As the gas-works adjoin the building, it was deemed advisable to liberate the contents of the gasholder; and no damage was done.

Growth of Gas Consumption on the South Coast: Corrections.—In the report of the remarks of the Chairman of the Hastings and St. Leonards Gas Company given in the "JOURNAL" last week (p. 788), the rate of increase in the number of consumers since the removal of the works to Glyne Gap should have been given as 46 (not 0·46) per cent. A speck in the print from which the report was prepared was unfortunately mistaken for a decimal point. In the article on "Twenty-Five Years' Gas Progress at Brighton," on p. 713 of the previous issue, the sales of gas in 1886 and last year should have been given as 700 and 1279 millions.

Ottoman Gas Company, Limited.—In the report to be presented at the meeting of this Company next Tuesday, the Directors state that the gas-rental for the half year ended Dec. 31 amounted to £21,956 compared with £19,593 for the corresponding period of 1909; and that the net profit is £5753, against £5266 for the second half of 1909. The amount standing at the credit of the profit and loss account is £14,830. Out of this sum the Directors have transferred £4000 to the reserve fund (increasing it to £24,000); and they recommend the payment of a dividend at the rate of 7 per cent. per annum on the preference shares, less income-tax, and at the rate of 8 per cent. per annum on the ordinary shares, tax free. After these payments, there will be a balance of £7935 to be carried forward.

Professor Bone's Surface Combustion.—In the current issue of the "Ironmonger," some observations on this subject are made in the editorial columns. The writer considers that the problems which have to be solved are connected with the supply of the compressed air required to obtain the desired results. In large establishments, this could be accomplished quite easily, either with a small hot-air engine or an electric motor of low horse power working a compressor. When, however, the question of compressed air for domestic service is confronted, the difficulties appear more troublesome. It is suggested that at the outset the benefits of the system might be secured by employing the steel air-cylinder and hand-pump, the use of which has become quite familiar in connection with flare and incandescent mantle-lamps. The writer thinks it ought not to be a difficult matter to adapt a gas-cooker to burn with surface combustion bricks in place of burners and rings; the compressed air being supplied from a cylinder, charged in the manner suggested, and fixed somewhere near, or self-contained with, the oven and boiling sections. He considers such an arrangement could be understood and worked by the average housewife; and if in time the gas companies came to pipe for both air and gas under pressure, the cost of changing from the cylinder to the public service would be small, and the work easily accomplished. Meantime pioneer work would be proceeding, calculated to popularize the surface combustion system among those who are the best customers of gas companies.

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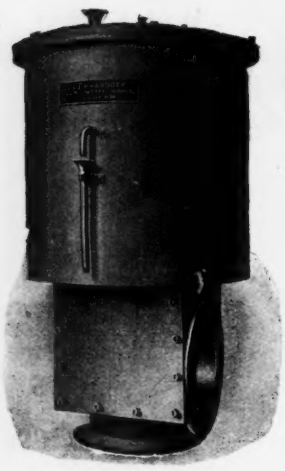

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Newport (I.W.) Public Lighting.—The Town Council of Newport (I.W.) recently accepted a tender submitted by the Gas Company for the public lighting, using 100-candle power lamps, for three years, at £3 per lamp per annum. The Electric Light Company made an offer of £2 17s. 6d. per lamp on a ten-years contract. By accepting the Gas Company's terms, as above, it was stated that a saving of 100 guineas would be effected.

San Paulo Gas Company, Limited.—At the annual meeting of the Company on Thursday, the Directors will report a satisfactory increase in the consumption of gas by private consumers in the year ended Dec. 31 last, it being nearly 15 per cent. in excess of that of 1909. The amount available for distribution is £26,891; and the Directors recommend the payment of a further dividend on the ordinary shares of 5 per cent., free of tax, making 9 per cent. for the year.

New Water-Works for Bedale.—New water-works for Bedale and the village of Aiskew were recently formally opened by Lady Beresford-Peirse, wife of the Chairman of the Bedale Rural District Council. The new works are situated 200 feet above the sea at Aiskew. They have been designed and carried out under the superintendence of Messrs. Fairbank and Son, of York and London; the Contractor being Mr. John Lant, of Newcastle-on-Tyne. The scheme was first reported upon by the Engineers fourteen years ago, when they recommended the present scheme—viz., to utilize the Keeper's Wood springs by pumping. After due consideration of various other schemes, the original proposal was finally adopted in 1908—viz., collecting the main spring and picking up all subsidiary springs *en route*. The water is conducted in cast-iron pipes to two powerful hydraulic rams, and then forced up to the reservoir, which is capable of holding 50,000 gallons. The rams deliver about 43 per cent. more water than will be actually required for the present population.

Hull Corporation Water Supply.—The Water and Gas Engineer of the Hull Corporation (Mr. C. B. Newton, M.Inst.C.E.) has lately issued his annual report on the water supply of the city. It shows that the total quantity of water drawn from the wells last year was 4,136,014,000 gallons—being 2,178,055,000 gallons from Springhead and 1,957,959,000 gallons from Cottingham. The supply per head per day within the water limits was 39·20 gallons; through meters, 10·36 gallons; for domestic and unmetered trade purposes, 30·31 gallons. The area of the district within which the Corporation are authorized to supply water is the same as before—viz., 16,377 acres, or 25·59 square miles. In addition, they sell water in bulk to the Cottingham Urban District Council for the district of Cottingham, and to the Sculcoates Rural District Council for the Sutton and Preston districts. The estimated average population supplied within the water limits during the past year was as follows: Within the city boundary, 280,006; outside, 6194; total, 286,200. During the past year, 20,496 yards, or 11·64 miles, of new mains were laid and 262 fire-hydrants fixed, and 10,941 yards, or 6·21 miles, of mains were taken up or disused; making a net increase of 9555 yards, or 5·43 miles. The total length of mains on Dec. 31 was 272·82 miles.

Gas and Water Works for Sale.—It will be seen from an announcement in another part of the "JOURNAL" that on the 28th inst. Messrs. A. & W. Richards will offer for sale, by order of the debenture-holders, the freehold gas and water works of the Meldreth and Melbourn District Gas and Water Company, Limited. It is not often that an opportunity occurs of buying such an undertaking as this as a going concern; and therefore attention may be specially directed to the particulars to be found elsewhere. Meldreth lies about midway between Royston and Cambridge.

Additional Capital for the Cambridge Water Company.—It will be seen from an announcement which appears elsewhere that the Cambridge Water Company are inviting tenders for an issue of £25,000 of 7 per cent. stock. It is the first portion of the stock authorized by their Act of last session; and it is offered at a minimum price of £145 per £100. Since the passing of the Act, similar stock has been sold by auction at an average price of £164. The Company have paid maximum dividends since 1874. Tenders for the new issue must be delivered at the Company's offices in Cambridge by ten o'clock on the morning of the 6th prox.

Lichfield Gas Company and the Chasetown Gas Bill.—A public meeting of ratepayers of Burntwood was held a few days ago to protest against the Chasetown Gas Company's Bill, and to support the Lichfield Gas Company in their opposition to it. Mr. R. R. Plant presided, and appealed strongly for support for the Lichfield Gas Company. He said they were already laying mains through Hammerwich, and if the Bill were defeated residents in Burntwood would soon be able to have gas laid on if they required it; but if the Bill passed, it would be years before they would get it, if they ever did. Lichfield gas was, moreover, cheaper and better than that supplied by the Chasetown Company. A resolution supporting the Lichfield Company's opposition to the Bill was carried. It was also resolved to make the Member of Parliament for the division (Sir Courtenay Warner) acquainted with the facts of the case.

Municipal Coal Supply Question Again.—Mr. Phillips moved, at a special meeting of the Manchester City Council last week, "That it be referred to a Special Committee to consider and report as to the desirability of the Corporation undertaking the supply of fuel." Amid signs of impatience from many members, Mr. Phillips pointed out how the rates were being heavily burdened to-day, and said the city must look for more sources of revenue. The Gas Committee bought coal at 12s. 0½d. per ton, equal to the good house coal sold to householders at £1 a ton. Allowing 4s. a ton for handling, the citizens could be saved 4s. a ton in their purchases. No new principle was embodied in the proposal; for the Gas Committee were now selling coal one stage removed—coke, gas, and various bye-products. The proposal was simply to extend a principle already in operation. Mr. Jones seconded the proposition; but the Council would not hear the matter further, and proceeded to the next business. So the agitation on this subject has again proved abortive.

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The Kirkconnel Gas Company was registered in Edinburgh last week. The capital is £5000, in £1 shares.

Mr. F. J. Pinchbeck has been appointed resident representative in Ireland for Messrs. Thomas Glover and Co. and R. & A. Main, Limited.

Mr. Hugh Strathearn, who has managed the Glasgow branch of Messrs. James Milne and Son's business for the last 24 years, will remove early in April to the works and head office in Edinburgh; and Mr. James A. Drummond, who has been with the Company for some 17 years, will take the management of the Glasgow branch, under the supervision of Mr. Strathearn.

The report for last half year of the Alliance and Dublin Consumers' Gas Company indicates a slightly improved position. The profit balance is £37,368. The Directors again recommend a dividend at the rate of 5 per cent. per annum, and carry forward £5204, against £438. The dividend is equivalent to the old 10 and 7 per cent. dividends on the former share capital, before the consolidation came into effect for dividend purposes a year or so ago.

At the second annual tea and smoking concert of the employees at the Burslem Gas-Works, which took place a few evenings ago, under the presidency of Mr. T. Mitchell, the Chairman of the Gas Committee of the Federated Council, a presentation, consisting of a tobacco jar and pipe, was made to Mr. John Kelly, who has been an employee at the works for fifty-one years. The Chairman said he was sure Mr. Kelly would value the gift, knowing that every one of his fellow-workmen had contributed towards it. An employee who had served so long deserved, not only the appreciation of his colleagues, but that of the Gas Committee. The gathering took place in connection with the Sick, Burial, and Benevolent Society, of which Mr. Edward Jones, the Gas Manager, is President, and of which all the men are members.

On the evening of the 8th inst., Alderman Hart, who has been elected Chairman of the Canterbury Gas and Water Company in succession to the late Mr. Daniel Amos, entertained the employees of the Company at dinner. The gathering, which was of a very pleasant character, included several of Alderman Hart's personal friends. In the course of his address, he referred to his tenure for forty-six years of a directorship of the Company, and to his constant endeavour to study the varied interests of the employees, who had done so much to bring the Company into its present excellent position. During the proceedings, testimony was borne to the great services rendered by Alderman Hart to Canterbury, with the public life of which he has been connected for half-a-century, as a member of the Corporation, Mayor, Sheriff, and in other capacities.

APPLICATIONS FOR LETTERS PATENT.

5512.—Seddon, E. H. & A., "Securing globes or cylinders of inverted lamps." March 6.
5578.—Underwood, G. F., "Inverted burners." March 6.
5604.—Truscott, W., and Whiting, H., "Generators for acetylene." March 6.
5638.—Grenfell, G. P., and Ditcham, W. T., "Igniting gas-lamps." March 7.
5642.—Coward, A. E., "Acetylene machines." March 7.
5645.—Holden, T., "Mantle-holder." March 7.
5651.—Simon, E. D., "Removal of naphthalene from coal-gas." March 7.
5663.—Shenton, G. H., "Separating gases." March 7.
5667.—Fabry, R., "Recovering ammonium sulphate direct from gas." March 7.
5672.—Newsome, A., "Utilizing the waste light from lamps for advertising." March 7.
5743.—Hall, T., "Billiard-table gas-shades." March 8.
5759-60.—Pitts, S. T., "Bye-pass tap." March 8.
5761.—Pitts, S. T., "Petrol gas machine." March 8.
5781.—Hopkinson, J. K., "Stop-taps." March 8.
5782.—Raigov, H., "Gas-lamps." March 8.
5788.—Pool, E. S., "Reflectors for lamps." March 8.
5837.—Feld, W., "Effecting the removal of sulphuretted hydrogen or of both sulphuretted hydrogen and ammonia from gases." March 8.
5838.—Feld, W., "Effecting the combination with sulphurous acid of ammonia or of ammonia and sulphuretted hydrogen contained in gases, vapours, or liquids, and the obtainment of ammonium sulphate." March 8.
5841.—Brown, T. W., and Tilley, F. C., "Controlling the bye-passes of gas-burners." March 8.
5842.—Brown, T. W., and Tilley, F. C., "Controlling the gas to bye-pass burners in high-pressure gas-lighting." March 8.
5865.—Cutler, S., jun., "Charging vertical retorts." March 8.
5913.—Stott, V. H., and Schofield, L., "High-pressure gas governors." March 9.
5931.—Brayshaw, E. R., "Burners for furnaces." March 9.
5956.—Howard, C. G., "Appliance for holding two lengths of tube or pipe to each other while being joined up, particularly of use for gas-meter unions and the like." March 9.
5962.—Coppée, E., "Manufacture of gas." March 9.
5965.—Graetz, M., "Incandescent gas-lamps." March 9.
5968.—Scheidegger, A., "Protector for mantles." March 9.
5989.—Dumontier, F., "Generating and burning gas." March 9.
6063.—Anderson, C. A., "Gas-pumps." March 10.
6070.—Sumner, R., "Mantles." March 10.
6094.—Coumbary, A., Buronfosse, A., and Linder, P., "Carburation of air." March 10.
6102.—Atkinson, J. R., "Gas-escape." March 11.
6118.—Holmes, W. C., & Co., Ltd., and Gray, H. A. B., "Valves." March 11.
6132.—Smith, J., jun., "Carburetted air gas." March 11.
6164.—Orten-Böving, J., "Pipe-joint." March 11.
6182.—Wasserzier, H., "Electric ignition of gas-burners." March 11.

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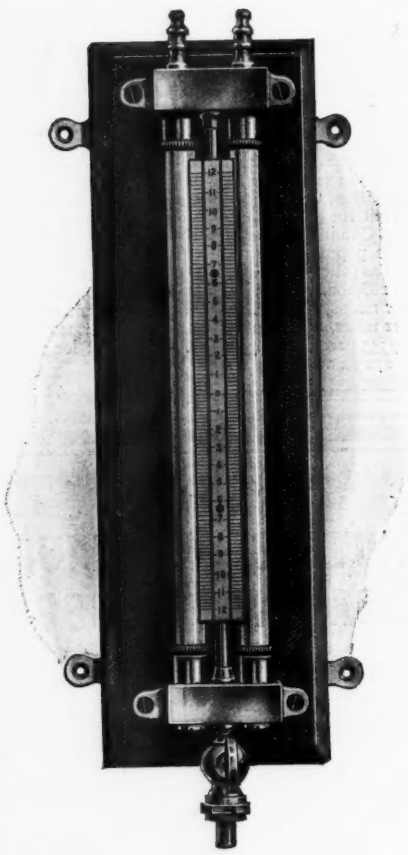

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The Directors of the Gas and Commercial Securities Corporation, Limited, have declared an interim dividend at the rate of 5 per cent. per annum, free of income-tax, on the ordinary shares for the half year to the 28th ult.

In the Chancery Division of the High Court of Justice a few days ago, Mr. Justice Swinfen Eady, on the petition of two contributories of Methane, Limited, ordered the name of the Company to be restored to the register, on the ground that a Company wished to make use of the Methane Company's patents in connection with a process which had been discovered.

The accounts to be presented at the annual general meeting of Messrs. Glover and Main, Limited, to-morrow show that the dividends on investments and the rents receivable in respect of the Edmonton and Falkirk factories amounted last year to £17,500; making the total revenue (including transfer fees) £17,501. After charging the expenses of the year, interest upon the mortgage debenture stock and loans, and the amount written off the value of the Edmonton and Falkirk factories, there is a net revenue balance of £12,748, to which is to be added the sum of £703 brought forward. After deducting the interim dividend, there remains a balance available for distribution of £8202. The Directors recommend that the following dividends should be declared: At the rate of 5 per cent. per annum (less income-tax) for the six months ended Dec. 31 upon the preference share capital, £1250; at the rate of 6 per cent. per annum (less income-tax) for the same period, making with the interim dividend 5 per cent. for the year, upon the ordinary share capital, £6000—amounting together to £7250, and leaving a balance of £952 to be carried forward.

At the meeting of the General Purposes Committee of the Dewsbury Corporation last Thursday, the salary of the Gas Manager (Mr. G. W. Fligg) was increased by £50 per annum.

This being the Jubilee year of the Fylde Water-Works, the Water Board have decided to publish a history of the undertaking, prepared by their Secretary (Mr. C. Arthur). The Royal Assent to the Fylde Water-Works Company's Act was given on July 22, 1861, and the water first supplied to the district in 1864. The works were acquired by the Board twelve years ago.

In the report which the Directors of Messrs. C. & W. Walker, Limited, will present at the general meeting on the 30th inst., they state that the profit for the year ended Jan. 31, after charging Directors' fees and depreciation on buildings and plant, amounts to £7178. After adding the balance brought forward and deducting the interim dividends (£3100) paid in August last, there remains for disposal the sum of £12,476, which the Directors recommend should be appropriated as follows: To pay a dividend at the rate of 5½ per cent. per annum on the preference shares for the six months ended Jan. 31 last, £1100; to pay a dividend at the rate of 10 per cent. per annum, free of income-tax, on the ordinary shares for a like period, £2000; to add to the reserve fund (making it £27,000), £2000; to carry forward to next year, £7376. Though the volume of trade done during the year was well maintained, the Directors regret that competition was such that the percentage of profit has been very much reduced. The whole of the goodwill has now been written off. A large sum has been recently spent in additional modern machinery, which will in future materially reduce the cost of production.

TAR PRODUCTS PRICES.

Representative manufacturers give the following as fair current values for the week ending March 18. Prices are net, and they include the usual packages and delivery f.o.b., f.a.s., or f.o.r., as customary.

Article.	Basis.	London.	North-East Coast.	East Coast, Yorks.	West Coast.		Glasgow.
					Liverpool.	Manchester.	
Tar crude	per ton	—	19/0 22/3	18/9 22/3	18/6 21/-	18/9 21/-	—
Pitch	,,	37/-	36/- 36/6	36/-	35/6	35/-	35/- 36/-
Benzol, 90%	per gallon	—	-/9½	-/9	-/8½	-/8¾	-/9½
Benzol, 50-90%	,,	—	-/9¼	-/9½	-/8½	-/8¾	—
Toluol, 90%	,,	—	-/9½	-/10	-/10	-/10	-/9¾
Crude naphtha, 30%	,,	—	-/3⅝	-/4	-/3½	-/3¾	—
Light oil, 50%	,,	—	-/3½	-/3¾ -/4	-/3¼	-/3½	—
Solvent naphtha, 90-160	,,	—	-/10½ -/11	-/10	-/10	-/11	-/11
Heavy naphtha, 90-190	,,	—	-/11	-/11½	-/11¼	-/11½ 1/-	-/11
Creosote in bulk	,,	-/2⅝	-/2 -/2¼	-/2	-/2⅛	-/2⅛	-/1⅞
Heavy oils	,,	—	-/2⅛ -/3	-/2¼	-/2⅜	-/2⅞	-/2¾
Carbolic Acid, 60's	,,	—	1/8 1/9	1/9½	1/7	1/7 1/8	1/9
Naphthalene, crude drained salts	per ton	—	42/6 45/-	40/- 42/6	47/6	47/6 50/-	—
,, pressed	,,	—	60/-	63/-	60/-	60/- 72/6	—
,, whizzed	,,	—	—	—	70/- 72/6	70/- 75/-	63/-
Anthracene	per unit	-/2	-/1⅜	-/1½	-/1¼	-/1¼	—

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 827.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.	Issue.	Share.	When Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.	£			p.c.				£ s. d.
1,551,868	Stk.	Oct. 14	5	Alliance & Dublin Ord.	82—85	..	5 17 8	4,940,000	Stk.	Nov. 11	9	Imperial Continental	191—193	..	4 13 3
374,000	Stk.	Jan. 13	4	Do. 4 p.c. Deb.	96—98	..	4 1 8	1,235,000	Stk.	Feb. 10	3½	Do. 3½ p.c. Deb. Red.	92—94	..	3 14 6
200,000	5	Oct. 28	7	Bombay, Ltd.	6½—7	..	5 0 0	200,242	Stk.	Mar. 10	6	Lea Bridge Ord. 5 p.c.	119—121*	..	4 19 2
40,000	5	,,	7	Do. New, £4 paid	5—5½	..	5 1 10	561,000	Stk.	Feb. 24	10	Liverpool United A.	214—216	−1	4 12 7
50,000	10	Feb. 24	15	Bourne- 10 p.c.	28—29	..	5 3 5	718,100	,,	,,	7	Do. B.	161½—163½	..	4 5 8
311,810	10	,,	7	mouth Gas B 7 p.c.	16—16½	..	4 4 10	306,083	,,	Dec. 30	4	Do. Deb. Stk.	100—102	..	3 18 5
75,000	10	,,	6	and Water Pref. 6 p.c.	14½—15	..	4 0 0	75,000	5	Dec. 15	6	Malta & Mediterranean	4¾—5	..	6 0 0
380,000	Stk.	,,	12½	Brentford Consolidated	251—254	..	4 18 5	560,000	100	Oct. 1	5	Met. of 5 p.c. Deb.	102—104	..	4 16 2
330,000	,,	,,	9½	Do. New	196—199	..	4 15 6	250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	102—104	..	4 6 7
50,000	,,	,,	5	Do. 5 p.c. Pref.	122—124	..	4 0 8	541,920	20	Nov. 11	3½	Monte Video, Ltd.	12¾—13¼	..	5 5 8
206,250	,,	Dec. 15	4	Do. 4 p.c. Deb.	98—100	..	4 0 0	1,775,892	Stk.	Feb. 24	4¾	Newc'tle&G'tesh'd Con.	100½—101½	+1	4 6 2
220,000	Stk.	Mar. 10	11	Brighton & Hove Orig.	215—218*	..	5 0 11	529,705	Stk.	Dec. 30	3½	Do. 3½ p.c. Deb.	89—90	..	3 17 9
246,320	,,	,,	8	Do. A Ord. Stk.	155—158*	..	5 1 3	55,940	10	Mar. 10	7	North Middlesex 7 p.c.	14—15*	..	4 13 4
460,000	20	Sept. 29	10⅝	British	44½—45½	..	4 13 6	300,000	Stk.	Nov. 30	8	Oriental, Ltd.	139—141	..	5 13 6
109,000	Stk.	Feb. 10	6	Bromley, A 5 p.c.	116—118	..	5 1 8	60,000	5	Sept. 15	8	Ottoman, Ltd.	7—7½	..	5 6 8
165,700	,,	,,	4½	Do. B 3½ p.c.	87—89	..	5 1 2	31,800	53	Feb. 24	13	Portsea Island A	130—132	..	5 3 8
82,278	,,	,,	5½	Do. C 5 p.c.	106—108	..	5 1 10	60,000	50	,,	13	Do. B	123—125	..	5 4 0
55,000	,,	Dec. 30	3½	Do. 3½ p.c. Deb.	84—86	..	4 1 5	100,000	50	,,	12	Do. C	116—118	..	5 1 8
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	96—98	..	4 1 8	114,800	50	,,	10	Do. D and E.	101—103	..	4 17 1
100,000	10	—	—	Cape Town & Dis., Ltd.	3½—4½	..	—	398,490	5	Oct. 28	7	Primitiva Ord.	7⅞—8	..	4 7 6
100,000	10	—	—	Do. 4½ p.c. Pref.	6—6½	..	—	796,980	5	Dec. 30	5	Do. 5 p.c. Pref.	5½—5⅝	..	4 10 11
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	—	..	—	488,900	100	Dec. 1	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
100,000	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.	88—90	..	5 0 0	312,650	Stk.	Dec. 30	4	River Plate 4 p.c. Deb.	96—98	..	4 1 8
157,150	Stk.	Feb. 24	5	Chester 5 p.c. Ord.	107—109	..	4 11 9	250,000	10	Sept. 29	9	San Paulo, Ltd.	15⅝—16⅛	..	5 10 9
1,513,280	Stk.	,,	5/9/4	Commercial 4 p.c. Stk.	113—116	+1	4 14 3	115,000	10	,,	6	Do. 6 p.c. Pref.	11⅞—12¼	..	4 18 0
560,000	,,	,,	5⅛	Do. 3½ p.c. do.	108—110	..	4 16 11	125,000	50	Jan. 3	5	Do. 5 p.c. Deb.	50—51	..	4 18 0
475,000	,,	Dec. 15	3	Do. 3 p.c. Deb. Stk.	77—79	..	3 15 11	135,000	Stk.	Aug. 31	10	Sheffield A	235—237	..	4 4 5
800,000	Stk.	,,	4	Continental Union, Ltd.	95—97	..	4 2 6	209,984	,,	,,	10	Do. B	235—237	..	4 4 5
200,000	,,	,,	7	Do. 7 p.c. Pref.	136—138	..	5 1 5	523,500	,,	,,	10	Do. C	235—237	..	4 4 5
492,270	Stk.	—	5½	Derby Con. Stk.	122—124	..	4 8 9	70,000	10	Oct. 14	6	South African	10½—11	..	5 9 1
55,000	,,	—	4	Do. Deb. Stk.	104—105	..	3 16 2	6,429,895	Stk.	Feb. 10	5/9/4	South Met., 4 p.c. Ord.	119—121	..	4 10 3
148,995	,,	Oct. 14	5	East Hull 5 p.c. Ord.	103—105	..	4 15 3	1,895,445	,,	Jan. 13	3	Do. 3 p.c. Deb.	79—81	..	3 14 1
486,090	10	Jan. 27	12	European, Ltd.	26—27	..	4 8 11	209,820	Stk.	Mar. 10	8	South Shields Con. Stk.	152—154*	..	5 3 11
354,060	10	,,	12	Do. £7 10s. paid	19½—20½	..	4 7 10	605,000	Stk.	Feb. 24	5⅜	S'th Suburb'n Ord. 5 p.c.	118—120	..	4 14 4
16,179,445	Stk.	Feb. 24	4⅜	Gas- 4 p.c. Ord.	105½—106½	..	4 7 7	60,000	,,	,,	5	Do. 5 p.c. Pref.	118—120	..	4 3 4
2,600,000	,,	,,	3½	light 3½ p.c. max.	85—87	..	4 0 6	117,058	,,	Jan. 13	5	Do. 5 p.c. Deb. Stk.	122—124	..	4 0 8
4,062,235	,,	,,	4	and 4 p.c. Con. Pref.	101—103	..	3 17 8	502,310	Stk.	Nov. 11	5	Southampton Ord.	111—113	..	4 8 6
4,531,705	,,	Dec. 15	3	Coke 3 p.c. Con. Deb.	79—81	..	3 14 1	120,000	Stk.	Feb. 10	7	Tottenham A 5 p.c.	141—143	..	4 17 11
258,740	Stk.	Mar. 10	5	Hastings & St. L. 3½ p.c.	92—94*	..	5 6 5	483,940	,,	,,	5½	and B 3½ p.c.	115—117	..	4 14 0
82,500	,,	,,	6½	Do. do. 5 p.c.	—	..	—	149,470	,,	Dec. 15	4	Edmonton 4 p.c. Deb.	98—100	..	4 0 0
70,000	10	Oct. 14	11	Hongkong & China, Ltd.	17⅛—18	..	6 2 3	182,380	10	Dec. 30	8	Tuscan, Ltd.	9—9½	..	8 8 6
131,000	Stk.	Mar. 10	7⅜	Ilford A and C	143—146*	..	5 1 0	149,900	10	Jan. 3	5	Do. 5 p.c. Deb. Red.	98—100	..	5 0 0
65,780	,,	,,	5⅜	Do. B	113—115*	..	5 2 2	236,476	Stk.	Feb. 24	5	Tynemouth, 5 p.c. max.	112—113	..	4 8 6
65,500	,,	Dec. 30	4	Do. 4 p.c. Deb.	96—98	..	4 1 8	255,636	Stk.	Feb. 24	6¾	Wands- B 3½ p.c.	141—143	+1	4 14 5
								85,766	,,	Dec. 30	3	worth 3 p.c. Deb. Stk.	73—75	..	4 0 0

Prices marked * are "Ex. div."

With the title of "Joseph T. Robin, Limited," a Company was registered on the 15th inst., with a capital of £150,000 in £1 shares, to trade as incandescent gas-mantle manufacturers.

The Carlisle Town Council have agreed to a recommendation of the Gas Committee that an advertisement should be issued inviting applications for the post of Engineering Assistant at the gas-works; the salary to be £150 per annum.

At the meeting of the Manchester City Council last Wednesday, a recommendation of the Water Committee that the salary of the Secretary to the Water Department (Mr. William Blackstock) should be advanced by £50 per annum was adopted, but only after considerable discussion; the opponents to the increase contending that it should not be granted, as Mr. Blackstock is more than sixty-five years of age.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

ENGINEERING ASSISTANT. No. 5370. Application by April 5.
WORKS ASSISTANT. Waterford Gas Company.
HIGH PRESSURE GAS HEATED APPLIANCES. No. 5371.
GAS FITTER (COLONIES). No. 5369.

Situations, &c., Wanted.

ASSISTANT REPRESENTATIVE, SALESMAN, &c. No. 5367.
SULPHATE PLANT REPAIRER, &c. Davies, Shepherd's Bush.

Gas and Water Works for Sale (Going Concern).

MELDRETH AND MELBOURN GAS AND WATER COMPANY. By Auction. March 28.

Plant, &c. (Second-Hand), For Sale.

ENGINE AND EXHAUSTER. South Bank Gas-Works.
EXHAUSTER AND WASHER. Yeovil Gas-Works.
GAS PRODUCER PLANT. No. 5368.
HYDRAULIC MAINS, PIPES, MOUTHPIECES, CONDENSERS, WASHER-SCRUBBER, PUMPS, ENGINES, &c. Sutton-in-Ashfield Gas Department. Tenders by April 4.
PURIFIERS, SCRUBBER, EXHAUSTER AND STEAM ENGINE, AND GOVERNORS, &c. Newtownards Gas Department. Tenders by March 27.
STATION METER. Oldbury Gas Department.
STEAM-ENGINE AND EXHAUSTER, &c. Aberystwyth Gas Company.

Plant, &c. (Second-Hand), Wanted.

MOUTHPIECES AND LIDS. Yatton Gas Company.

Meetings.

BRITISH GASLIGHT COMPANY. London Office. March 29. Twelve o'clock.
ORIENTAL GAS COMPANY. London Office. March 28. One o'clock.

Stocks and Shares.

CAMBRIDGE WATER-WORKS COMPANY. By Tender. April 6.
LEATHERHEAD WATER COMPANY. By Auction. March 28.
MAIDSTONE GAS COMPANY. By Auction. March 28.
SOUTHEND WATER COMPANY. By Auction. March 28.
SUTTON GAS COMPANY. By Auction. March 28.
SWANSEA GAS COMPANY. By Auction. April 7.
UXBRIDGE GAS COMPANY. March 28.

TENDERS FOR

Coal and Cannel.

COMMERCIAL GAS COMPANY. Tenders by March 22.
MARPLE GAS DEPARTMENT. Tenders by March 28.
NEWPORT (FIFE) GAS DEPARTMENT. Tenders by April 1.
STOCKPORT GAS DEPARTMENT. Tenders by April 4.
ROTHWELL URBAN DISTRICT COUNCIL. Tenders by April 3.

Coke.

SHEPPY GAS COMPANY. Tenders by March 28.

Compressor and Gas-Engine, &c.

NEWTOWNARDS GAS DEPARTMENT. Tenders by March 27.

Drilling Machine.

NEWTOWNARDS GAS DEPARTMENT. Tenders by March 27.

General Stores (Lime, Oils, Shovels, Iron, Buckets, &c.)

MARPLE GAS DEPARTMENT. Tenders by March 28.
ROCHDALE GAS DEPARTMENT. Tenders by March 29.

Oxide of Iron (New and Spent).

BROADSTAIRS GAS COMPANY. Tenders by April 4.
KNOWLE GAS COMPANY.
NEWTOWNARDS GAS DEPARTMENT. Tenders by March 27.

Pipes, &c.

LIMERICK GAS COMMITTEE. Tenders by April 3.
ROCHDALE GAS DEPARTMENT. Tenders by March 29.

Tar and Liquor.

MARPLE GAS DEPARTMENT. Tenders by March 28.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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Telegrams: "DORIC," Newcastle-on-Tyne. National Telephone No. 2497.

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